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July 30, 2020

Gregg M. Worley, Acting Director
Air and Radiation Division
US EPA - Region 4
61 Forsyth Street, SW
Atlanta, GA 30303

Dear Mr. Worley:

In accordance with 40 CFR 58.10, the Alabama Department of Environmental Management (ADEM) has prepared the Five Year Network Assessment for the State of Alabama. Submission of the report was delayed due to workflow interruptions caused by COVID-19.

If I can provide additional information, please contact me at (334) 260-2783.

Sincerely,

Gina L Curvin

Gina L. Curvin, Chief
Ambient Air Monitoring Program Manager
Field Operations Division

Email: Todd Rinck, Chief, Air Data & Analysis Section (rinck.todd@epa.gov)
Email: Daren Palmer, Air Data & Analysis Section (Palmer.Darren@epa.gov)

Five Year Ambient Air Monitoring Network Assessment

For the State of Alabama

Department of Environmental Management

July 29, 2020

ADEM

Alabama Department of Environmental Management

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Introduction

This document is intended to detail the five year network assessment performed by ADEM. In Alabama, three agencies have ambient air monitoring networks; the Alabama Department of Environmental Management (ADEM), the Jefferson County Department of Health (JCDH), and the City of Huntsville Division of Natural Resources and Environmental Management (HDNREM). The US EPA also operates a site in Alabama under the CASTNET program. Each agency or program is considered its own primary quality assurance organization (PQAO) and will produce separate network assessments to be submitted independently to the Environmental Protection Agency (EPA). The requirement to submit an assessment of the air quality surveillance system is provided for in the Code of Federal Regulations §58.10, (d) which states:

> *"The state, or where applicable local, agency shall perform and submit to the EPA Regional Administrator an assessment of the air quality surveillance system every 5 years to determine, at a minimum, if the network meets the monitoring objectives defined in appendix D to this part, whether new sites are needed, whether existing sites are no longer needed and can be terminated, and whether new technologies are appropriate for incorporation into the ambient air monitoring network. The network assessment must consider the ability of existing and proposed sites to support air quality characterization for areas with relatively high populations of susceptible individuals (e.g., children with asthma), and, for any sites that are being proposed for discontinuance, the effect on data users other than the agency itself, such as nearby states and tribes or health effects studies. The state, or where applicable local, agency must submit a copy of this 5-year assessment, along with a revised annual network plan, to the Regional Administrator. The assessments are due every five years beginning July 1, 2010.*

This document will be organized by pollutants, such as, ozone, particulate matter, sulfur dioxide, and nitrogen dioxide and others. Within each section, the following items will be discussed. Each agency will assess these factors for the portion of the network in their jurisdiction.

- Whether the network meets the monitoring objectives defined in Appendix D.
- Whether new monitoring sites are needed.
- Whether existing sites are no longer needed and can be terminated.
- Whether new technologies are appropriate for incorporation into the air monitoring network.
- The ability of existing and proposed sites to support air quality characterization in areas with high populations of susceptible individuals (e.g., children with asthma).
- Whether site discontinuance would have an adverse impact on other data users or health studies.
- Whether population oriented monitors are located properly.

In order to assess the network's suitability for the seven objectives listed above, ADEM will consider the following:

- Statewide and local level population statistics.
- Statewide ambient air monitoring network pollutant concentration trends for the past 5 years.
- Network suitability to measure the appropriate spatial scale of representativeness for selected pollutants.
- Monitoring data spatial redundancy or gaps that need to be eliminated.
- Programmatic trends or shifts in emphasis or funding that lead toward different data needs.

Other considerations that are taken into account include:

- Statewide and local level emission source trends, characteristics, and inventories.
- Statewide plans to modify, add, or remove emission sources.
- Statewide and local level meteorological impacts on pollutant concentrations.
- Potential impacts of pollutant and precursor transport on measured concentrations.

Each year, all three agencies prepare a separate document that details the annual network review and description. For 2020, the ADEM Air Monitoring Plan was placed on ADEM's website on May 28, 2020 to begin a 30 day public review period. This document can be accessed at the following link:

http://adem.alabama.gov/programs/air/airquality/2020AmbientAirPlan.pdf

Or by contacting:

Gina L. Curvin, Chief Air/Facilities Section
ADEM - Field Operations Montgomery
P.O. Box 301463, Montgomery, AL 36130-1463
(Street address: 1350 Coliseum Boulevard, Montgomery, AL 36110-2059)
Or by e-mail: gcurvin@adem.alabama.gov

Several of the topics in this assessment, such as Appendix D requirements, are covered in detail in the annual review and will be referenced from this document.

Network Modification Plan

After completion and submittal of the **2020** 5-year Network Assessment, ADEM will prepare a Network Modification Plan and submit it as part of the **2021** Annual Network Plan. This plan and schedule will follow the federal requirements below.

> ***58.14 System modification. (a)*** *The state, or where appropriate local, agency shall develop a network modification plan and schedule to modify the ambient air quality monitoring network that addresses the findings of the network assessment required every 5 years by § 58.10(d). The network modification plan shall be submitted as part of the Annual Monitoring Network Plan that is due no later than the year after submittal of the network assessment.*

Definitions and Acronyms

AAQM	Ambient air quality monitoring
AAQMP	Ambient Air Quality Monitoring Program
ADEM	Alabama Department of Environmental Management
Appendix D	Volume 40, Code of Federal Regulations, part 58, Appendix D
AQS	Air Quality System
Avg	average
Bham	Birmingham
CBSA	Core Based Statistical Area
CFR	*Code of Federal Regulations*
CSA	Consolidated Statistical Area
EPA	Environmental Protection Agency
FEM	Federal Equivalent Method
FRM	Federal Reference Method
HDNREM	Huntsville Division of Natural Resources and Environmental Management
Hr	hour
hi-vol	high-volume PM_{10} sampler
JCDH	Jefferson County Department of Health
Low-vol	low-volume particulate sampler
m^3	cubic meter
min	minute
ml	milliliter
MSA	metropolitan statistical area
NAAQS	national ambient air quality standard
NCore	National core monitoring (multi-pollutant)
O_3	ozone
PAMS	photochemical air monitoring station
Pb	lead
PM	particulate matter
$PM_{2.5}$	particulate matter less than 2.5 micrometers diameter
PM_{10}	particulate matter less than 10 micrometer diameter
$PM_{10-2.5}$	particulate matter less than 10 microns but greater than 2.5 microns
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
SLAMS	state and local air monitoring station
SO_2	sulfur dioxide
SPM	special purpose monitor
STN	($PM_{2.5}$) Speciation Trends Network
TEOM	Tapered Element Oscillating Microbalance (Rupprecht and Patashnick Co.)
TPY	Tons per Year
TSP	total suspended particulate
URG	URG-3000N $PM_{2.5}$ Speciation monitoring carbon-specific sampler
USEPA	United States Environmental Protection Agency
° C	degree Celsius
$\mu g/m^3$	micrograms (of pollutant) per cubic meter (of air sampled)

Strategy for Ranking Sites in the Network

This assessment is intended to determine the adequacy of the current network to meet the monitoring objectives in the state. It is intended to identify the need for additional monitors or to determine if some monitors may be redundant. In this regard, a ranking system was developed to provide a framework for making these decisions. While this assessment may identify areas that could benefit from additional monitoring, it must be realized that monitoring resources are limited at both the state and local levels. Therefore goals may be established to provide additional monitoring but these will be dependent on future funding sources and/or may require equivalent offsets in existing monitoring efforts.

The following ranking system has been developed to assist with network decisions. Monitors which are assigned a higher rank will be determined to have a higher importance in the network. For example, monitors required by the 40CFR58, Appendix D federal regulations must be maintained and should receive a high rank.

Table 1 Ranking Matrix

Category	Comment
Appendix D required	Must be retained
Potential to exceed NAAQS	Important for $PM_{2.5}$ frequency and method decisions
Ozone NAAQS Probability	Probability of exceeding 80% of the Ozone NAAQS in the Next 3 Years.
$PM_{2.5}$ Annual NAAQS Probability	Probability of exceeding 80% of the $PM_{2.5}$ Annual NAAQS in the Next 3 Years.
$PM_{2.5}$ 24-hour NAAQS Probability	Probability of exceeding 80% of the $PM_{2.5}$ 24-hour NAAQS in the Next 3 Years.
Attainment History	Has indicated nonattainment within previous 5 years
Located in complex terrain	May represent unique air shed in the network
Used for AQI reporting	MSAs greater than 350,000 population report AQI daily
Fills AIRNOW Spatial Needs	Monitors may be needed to present a more accurate and representative map.
Used in outside studies	Where ADEM has been informed the monitor provides unique data for outside studies
Located in unique areas	Near road way, Near emission points
Background monitor	Used for App. D requirement and modeling studies
Transport monitor	Used for App. D requirement and modeling studies
Community concerns	Requested by the community to address specific concerns
Forecasting	Monitors in and outside of an MSA may be needed to perform required forecasting.

Current Sites

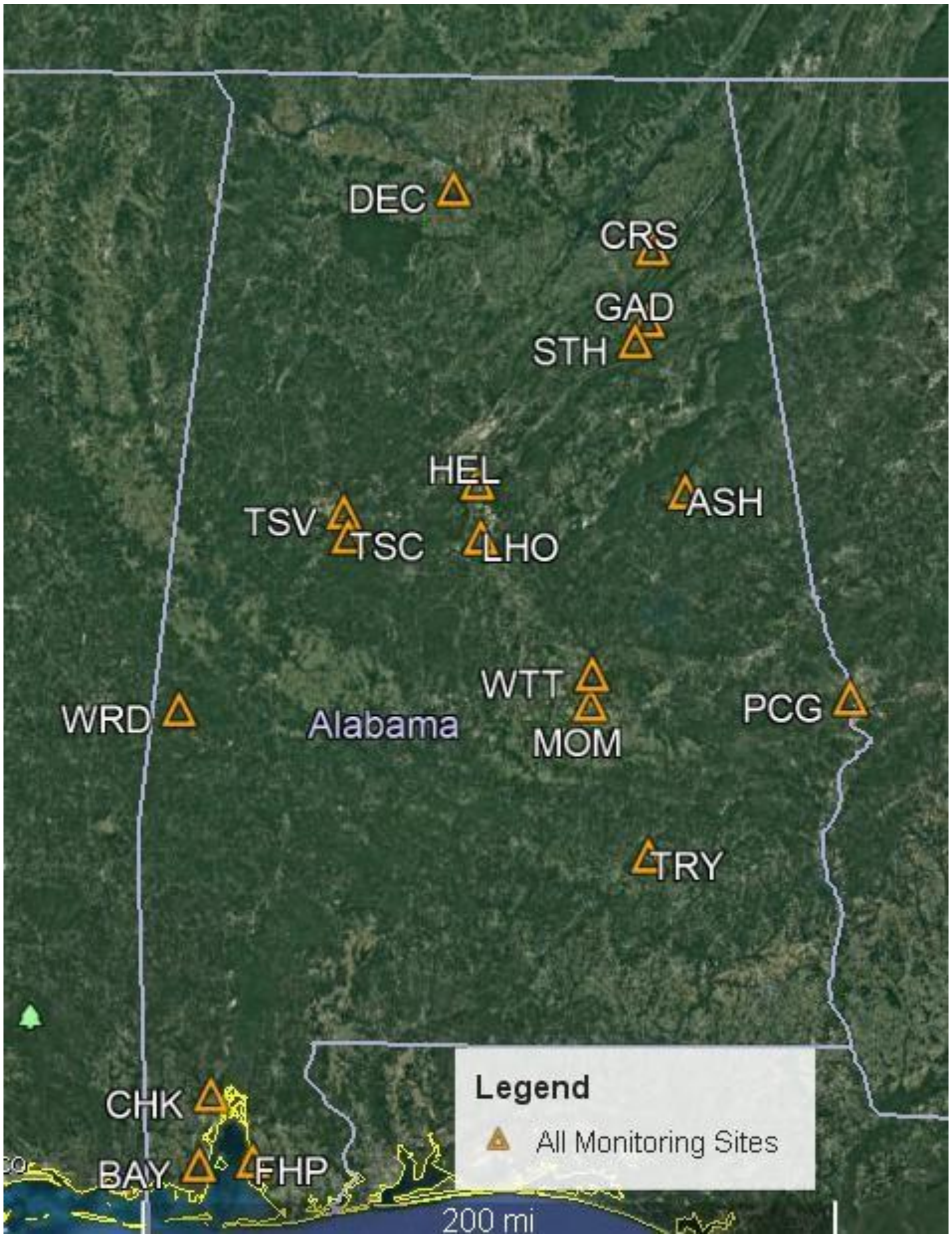


Figure 1 Map of Current Monitoring Locations

Population Distribution

Since much of the requirements for monitoring in Appendix D of part 58 are based on populations in metropolitan statistical areas, this section will describe the current population distribution throughout Alabama and changes over the last decade that could have an effect on whether the current network is continuing to meet the original objectives.

Alabama has a 2019 population estimate of 4,903,185. Alabama's Metropolitan and Micropolitan Core Based Statistical Areas with corresponding classifications as Metropolitan or Micropolitan, county names included in that area, and the 2019 estimated population totals are listed in Table 2. Minimum monitoring requirements vary for each pollutant and can be based on a combination of factors such as population, the level of monitored pollutants, and Core Based Statistical Area boundaries as defined in the latest U.S. Census information. The term "Core Based Statistical Area" (CBSA) is a collective term for both Metropolitan Statistical Areas (MSA) and Micropolitan Statistical Areas (µSA).

Approximately 76% of Alabama's total population resides in Metropolitan Statistical Areas. Alabama currently has 17 monitoring sites which monitor various pollutants. Thirteen or 76 percent of these sites are located in MSAs. Four sites are located outside of an MSA.

When considering the requirements for sulfur dioxide monitoring, both MSAs and µSAs are used (see Sulfur Dioxide (SO_2)). Approximately 93% of Alabama's population resides in either an MSA or an µSA.

Regional monitors used to measure background levels of pollutants or transport of pollutants are usually located outside of a CBSA.

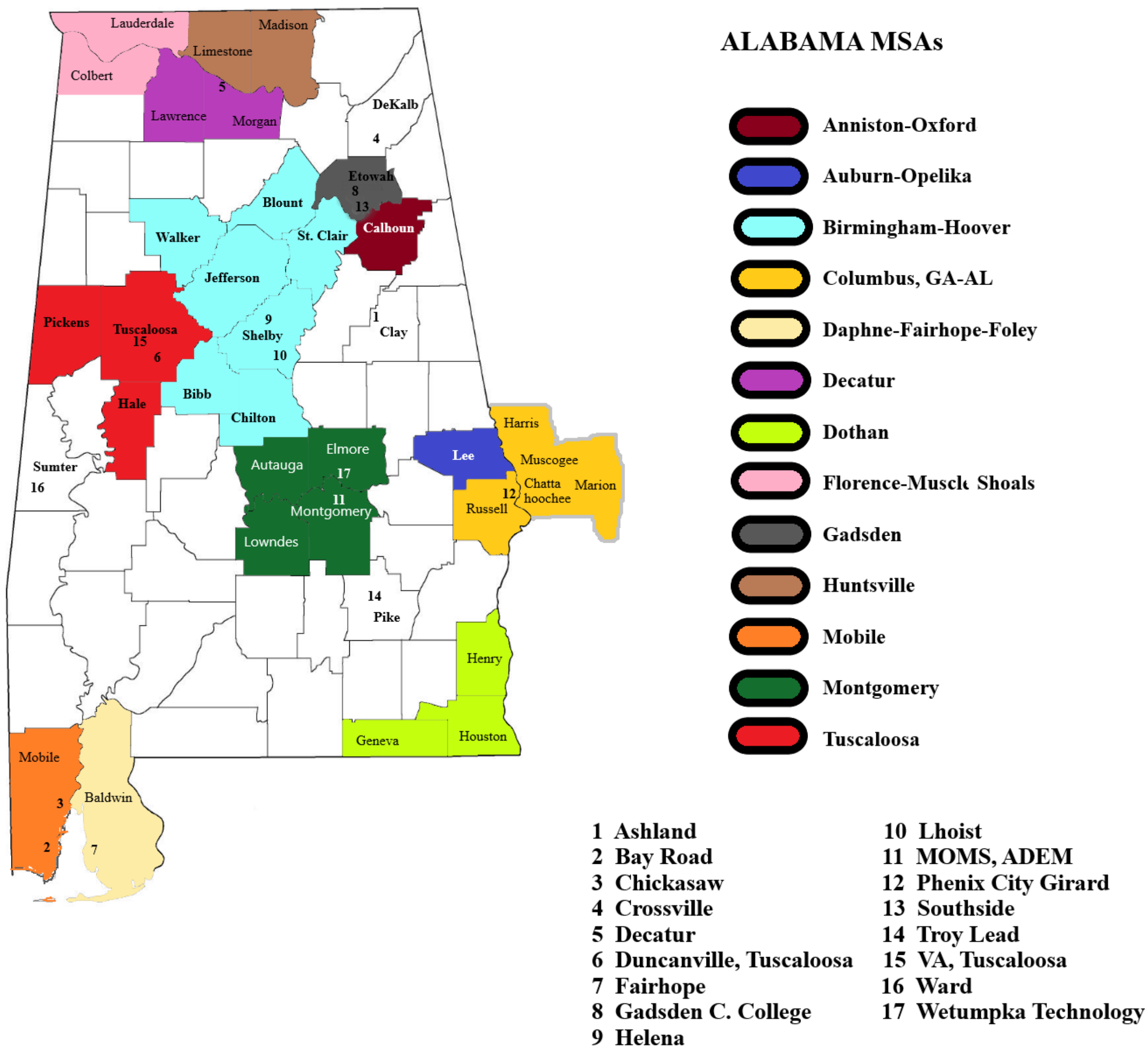


Figure 2 Alabama MSAs

Table 2 Alabama CBSAs

Alabama Core Based Statistical Areas	Counties in CBSA	2019 population estimate	Metropolitan or Micropolitan Statistical Areas
Anniston-Oxford	Calhoun	113,605	Metropolitan
Auburn-Opelika	Lee	164,542	Metropolitan
Birmingham-Hoover	Bibb, Blount, Chilton, Jefferson, Shelby, St. Clair, Walker	1,090,435	Metropolitan
Columbus, GA-AL	Russell County in Alabama and Chattahoochee, Harris, Marion, Muscogee Counties in Georgia Muscogee Counties in Georgia	321,048	Metropolitan
Daphne-Fairhope-Foley	Baldwin	223,234	Metropolitan
Decatur	Lawrence, Morgan	152,603	Metropolitan
Dothan	Geneva, Henry, Houston	149,358	Metropolitan
Florence-Muscle Shoals	Colbert, Lauderdale	147,970	Metropolitan
Gadsden	Etowah	102,268	Metropolitan
Huntsville	Limestone, Madison	471,824	Metropolitan
Mobile	Mobile	429,536	Metropolitan
Montgomery	Autauga, Elmore, Lowndes, Montgomery	373,290	Metropolitan
Tuscaloosa	Hale, Pickens, Tuscaloosa	252,047	Metropolitan
Albertville	Marshall	96,774	Micropolitan
Alexander City	Tallapoosa	51,030	Micropolitan
Atmore	Escambia	36,633	Micropolitan
Cullman	Cullman	83,768	Micropolitan
Enterprise	Coffee	52,342	Micropolitan
Eufaula, AL-GA	Eufaula, AL-GA Micro Area	26,985	Micropolitan
Fort Payne	DeKalb	71,513	Micropolitan
Jasper, AL	Jasper, AL Micro Area	63,521	Micropolitan
LaGrange, GA-AL	LaGrange, GA-AL Micro Area	103,176	Micropolitan
Ozark	Dale	49,172	Micropolitan
Scottsboro	Jackson	51,626	Micropolitan
Selma	Dallas	37,196	Micropolitan
Talladega-Sylacauga	Coosa, Talladega	79,978	Micropolitan
Troy	Pike	33,114	Micropolitan

State Wide Population Changes

The maps in Figure 3 were generated using the University of Alabama interactive maps website (http://alabamamaps.ua.edu/Interactive%20Maps/Demographics/popchange.html) and the maps in Figures 4 and 5 were prepared using data from the US Census Bureau.

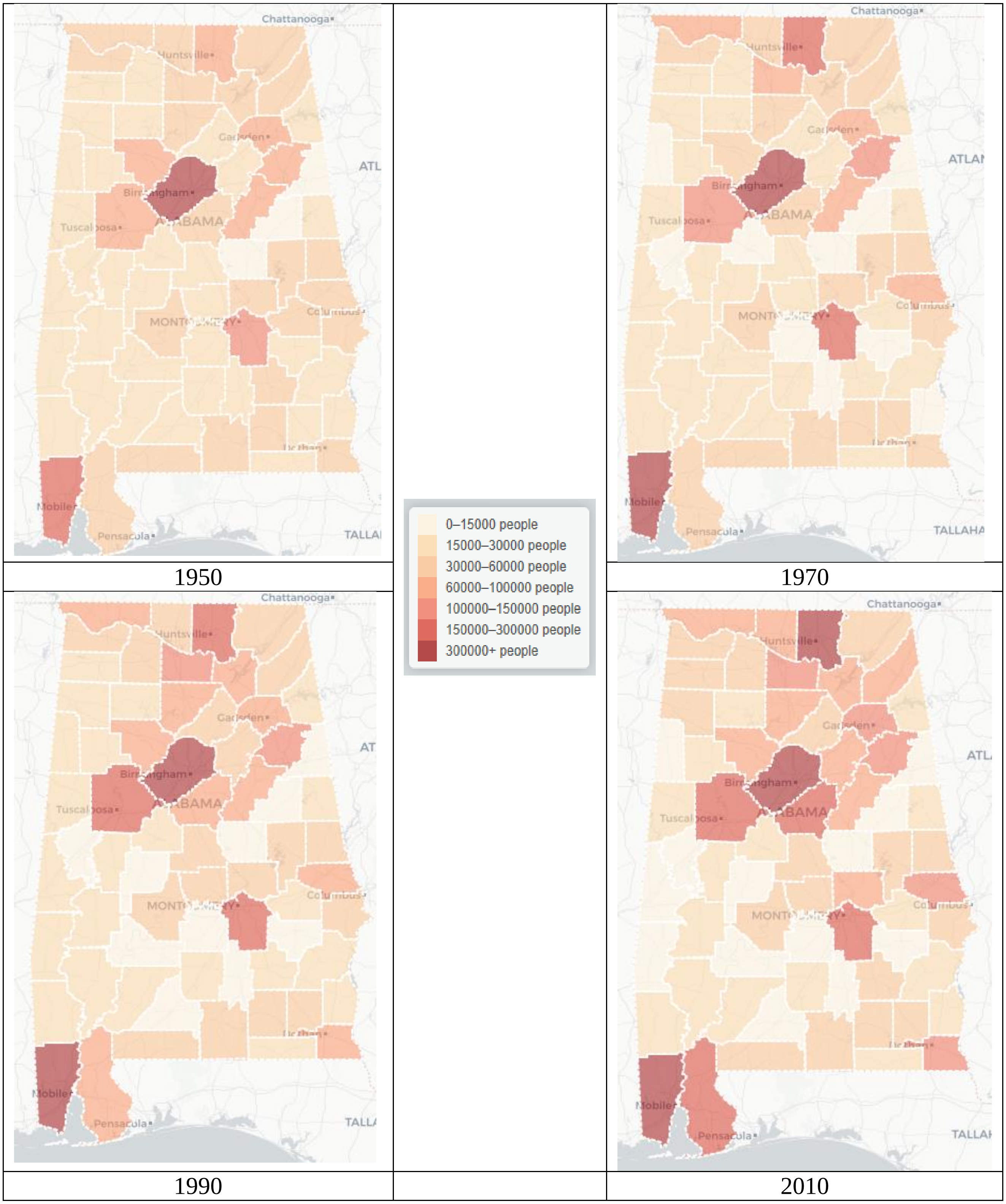


Figure 3 Population Maps from 1950 to 2010

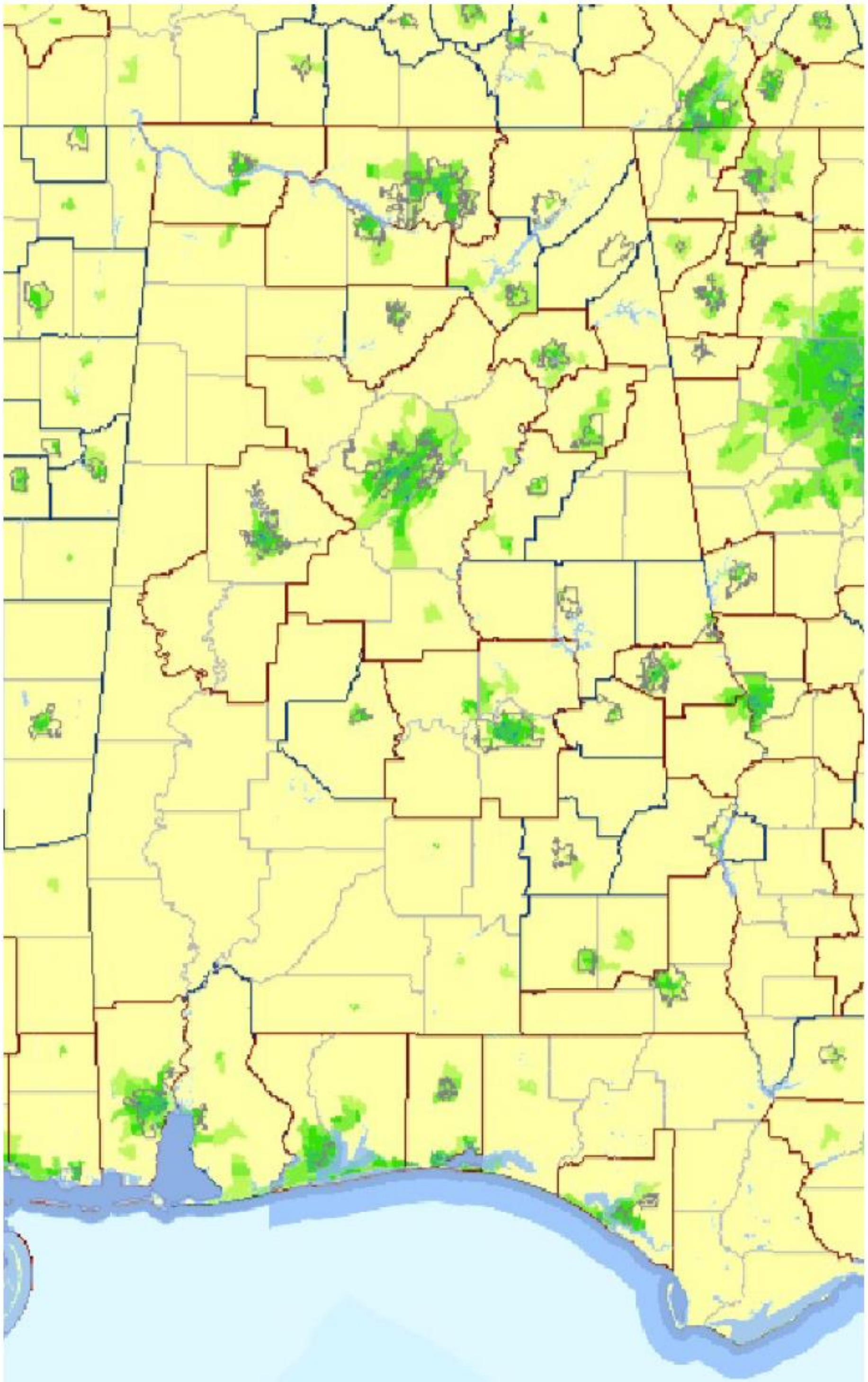


Figure 4 Population Density

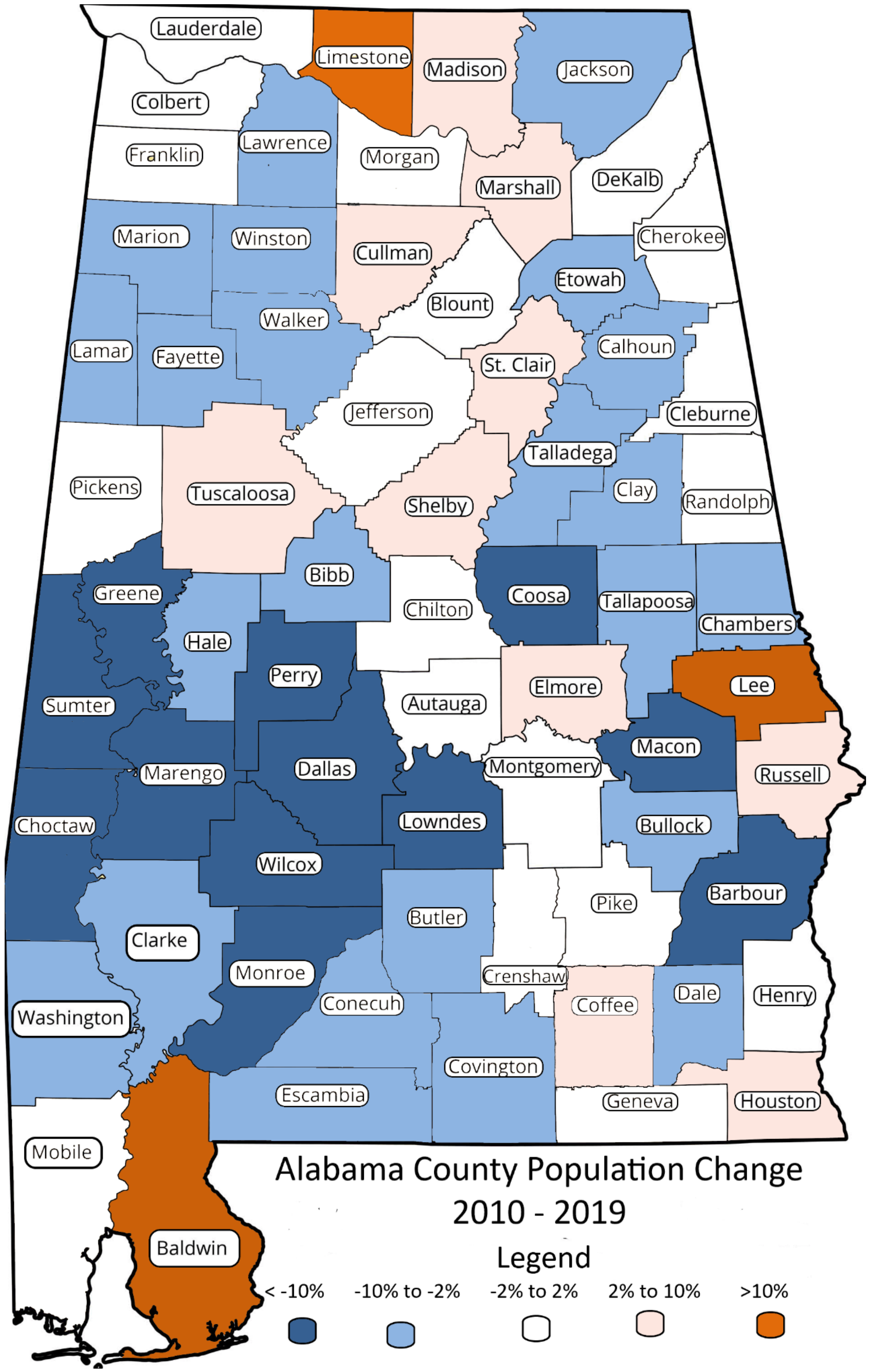


Figure 5 Population Change by County from 2010 to 2019

Who is Most Affected by Poor Air Quality?

People with COPD, Heart Disease and Asthma are among the groups of people who are most effected by poor air quality.

Asthma is a disease that affects your lungs. It causes repeated episodes of wheezing, breathlessness, chest tightness, and nighttime or early morning coughing. Asthma can be controlled by taking medicine and avoiding the triggers that can cause an attack. You must also remove the triggers in your environment that can make your asthma worse.

CDC's National Asthma Control Program works to help Americans with asthma achieve better health and improved quality of life. The program funds states, school programs, and non-government organizations to help them improve surveillance of asthma, train health professionals, educate individuals with asthma and their families, and explain asthma to the public.

ADEM doesn't have a map to indicate the location of these most affected individuals, however, it is known that there is a higher occurrence or severity of asthma among the younger, older and low income populations.

The percentiles of these populations are presented in the maps in Figure 6, Figure 7 and Figure 8. In general, there are higher populations over 65 in the more rural areas of Alabama. West Alabama seems to have pockets of higher percentiles of children less than 5 years old. Low income populations are found in higher concentrations in Alabama's Black Belt Region, especially in Sumter and Greene Counties. These populations are served by monitors that are not in MSAs such as the Ward site in Sumter County.

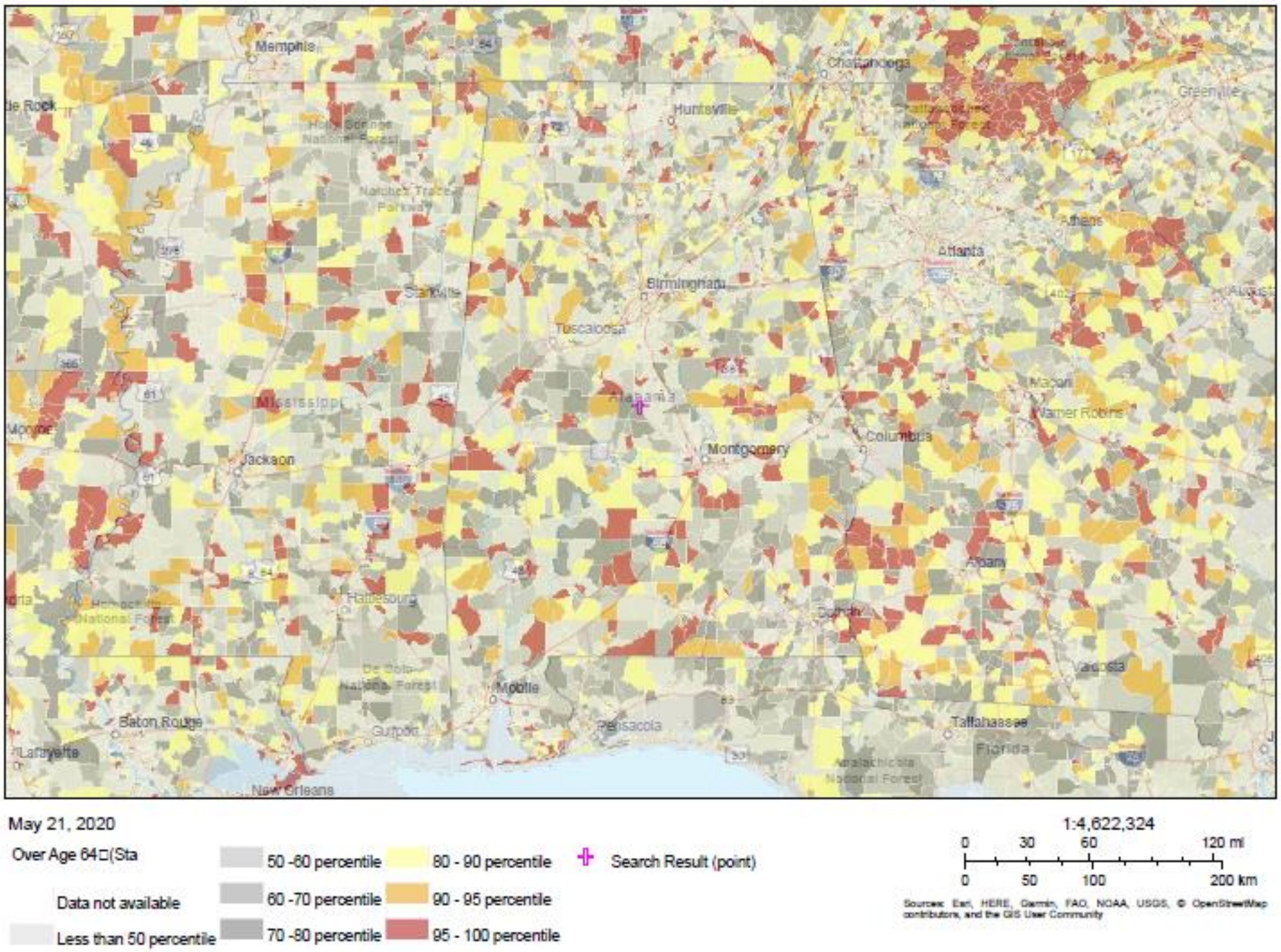


Figure 6 Percentiles Over Age 64

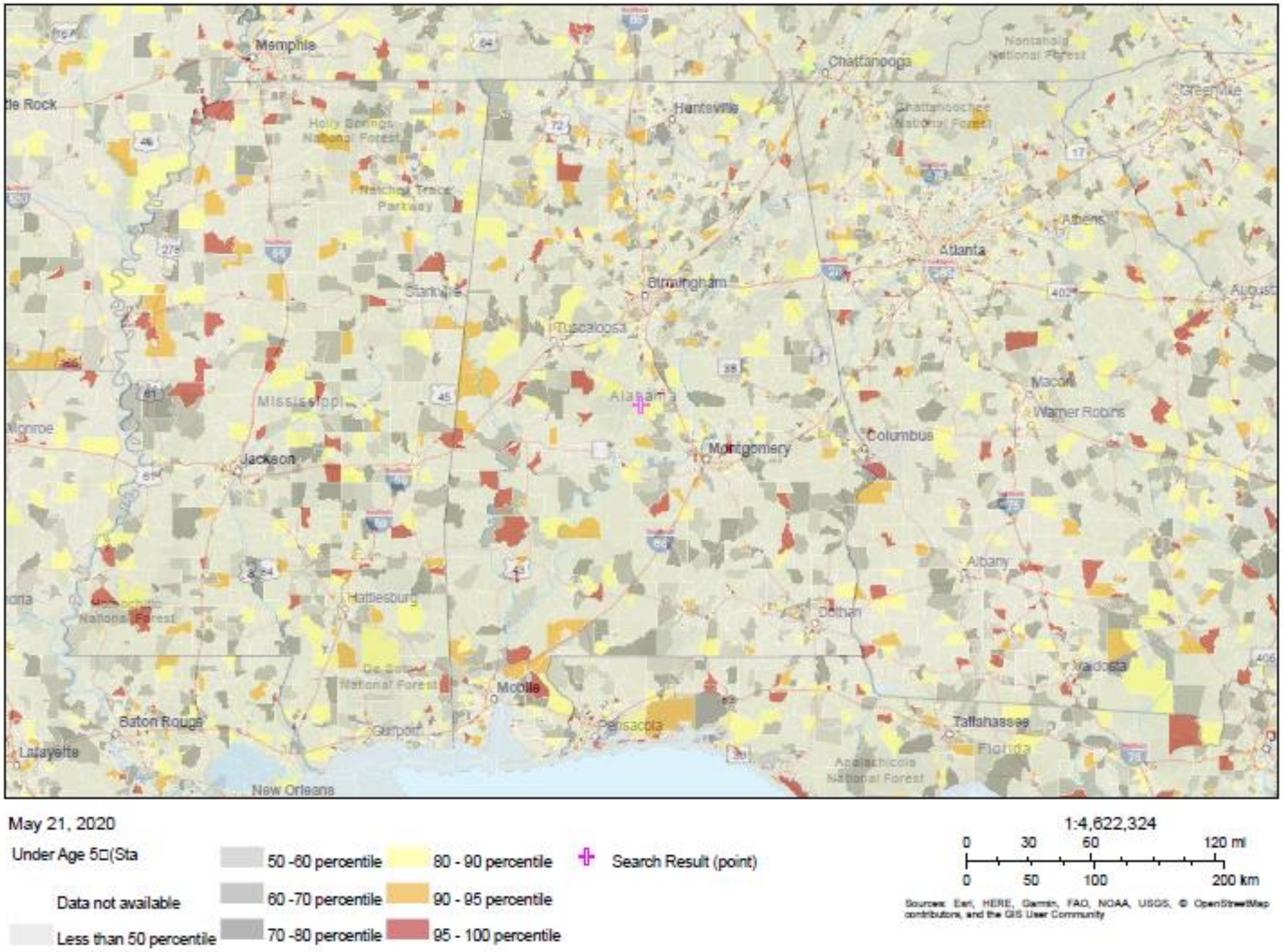


Figure 7 Percentiles Under Age 5

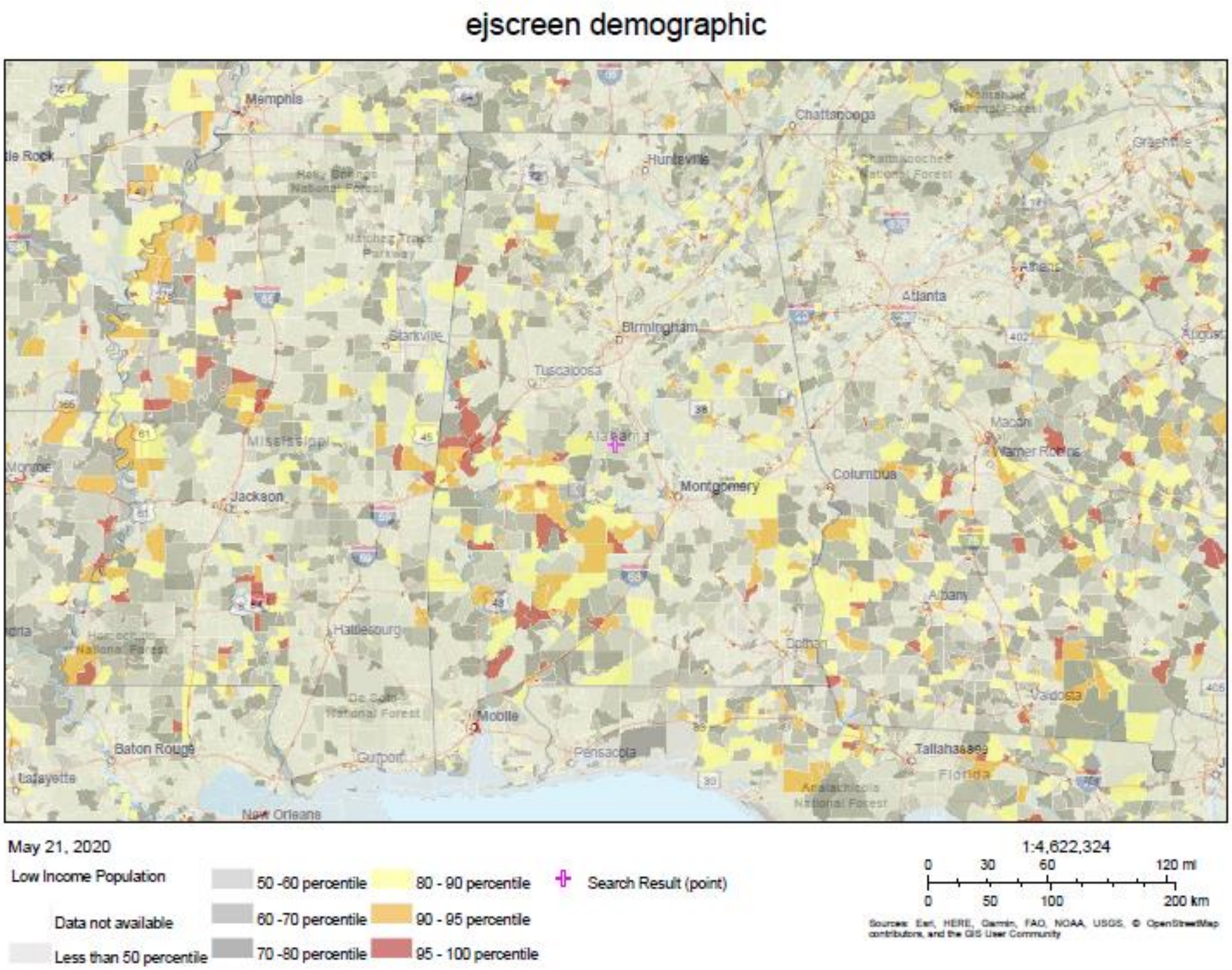


Figure 8 Percentiles of Low Income Population

Meteorological Data

Meteorological data is used for siting of monitors to meet the intended monitoring objectives, such as identifying the highest concentration in an area. The wind roses below provide one aspect of that analysis. The data in these wind roses includes 30 years of wind direction and speed at each location. The first of each set of roses includes the entire year. Since ozone monitoring is seasonal, the second set illustrates the most appropriate wind rose for ozone monitor siting. These only include data during the ozone season, March-October. Other pollutants are measured throughout the year so the annual wind roses are used for that purpose.

Wind Roses

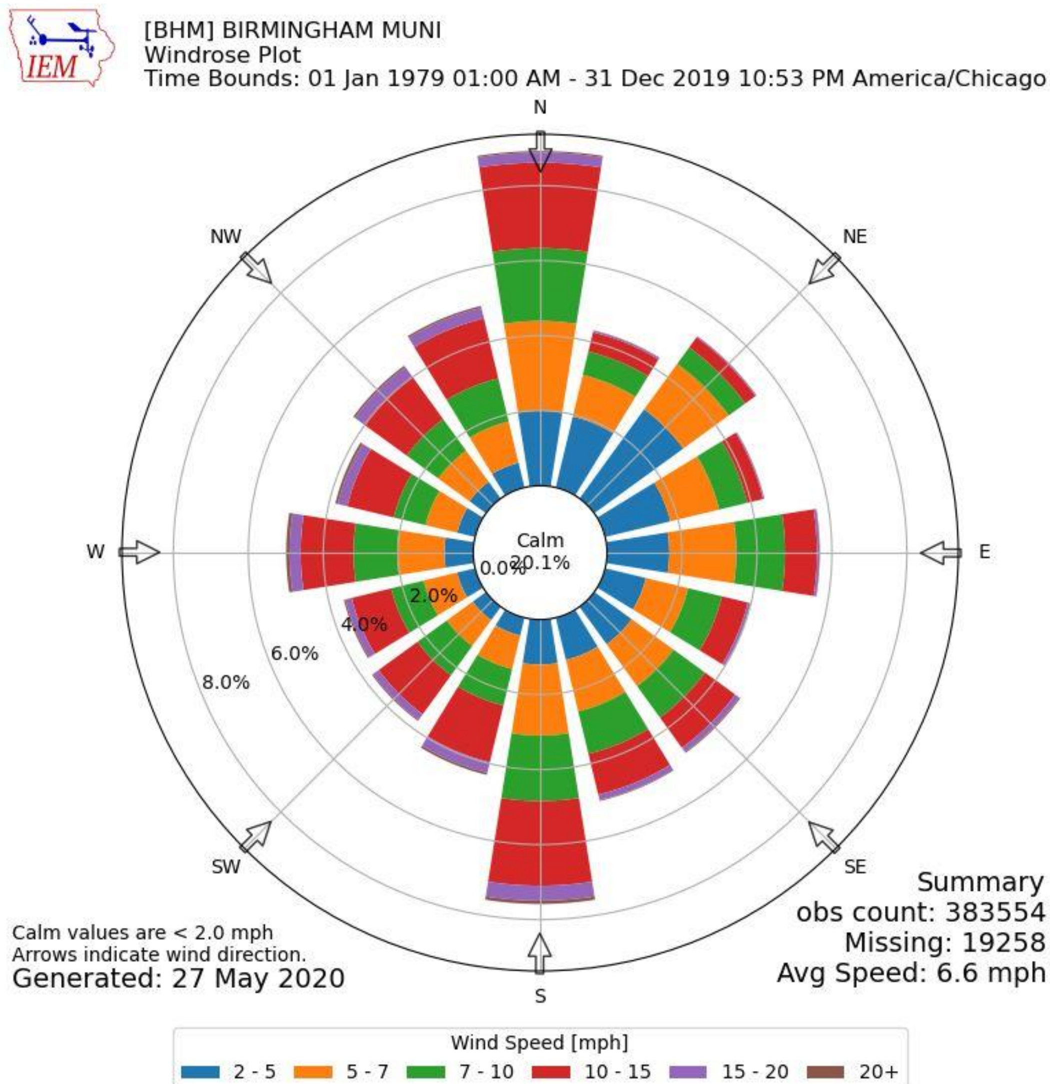


Figure 9 Birmingham 30 Year Wind Rose

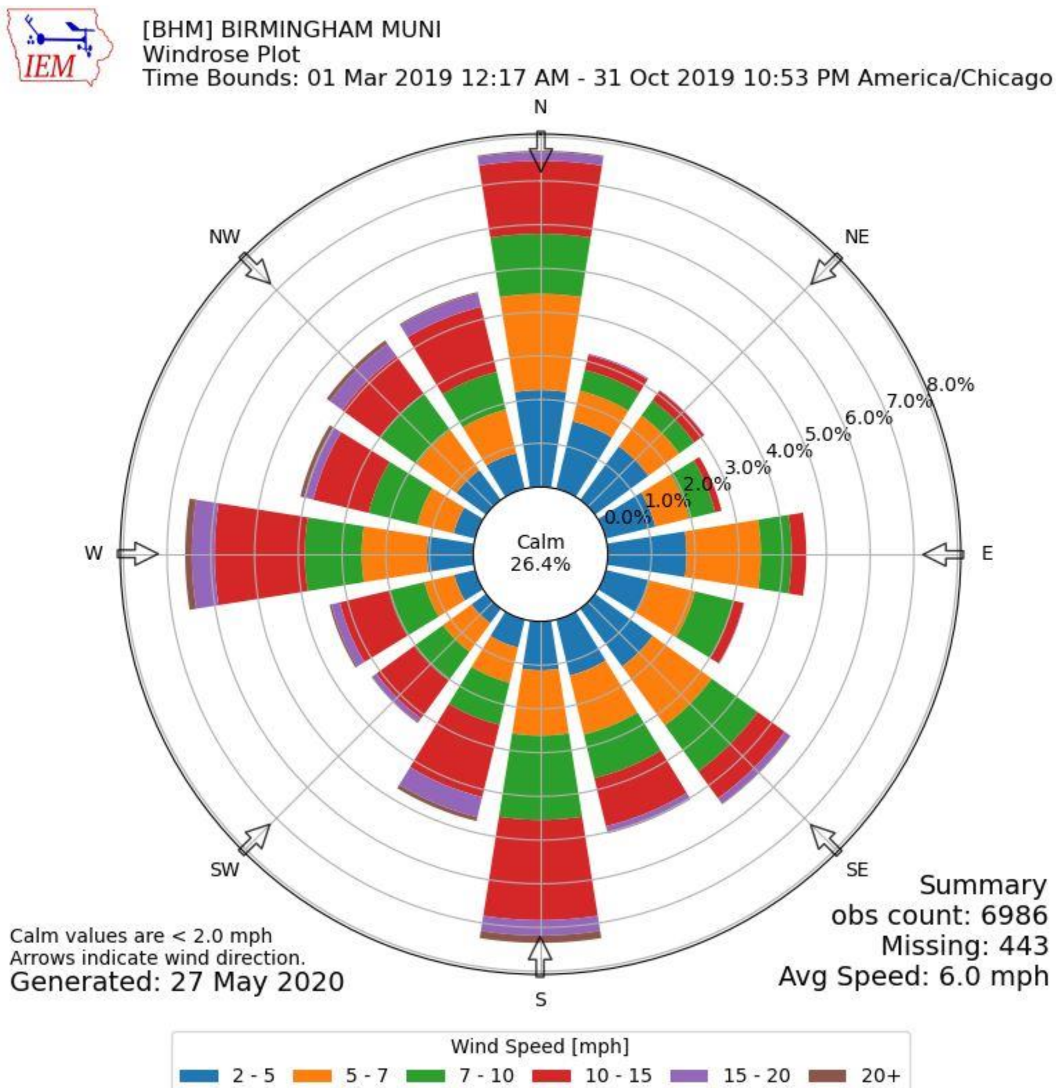


Figure 10 Birmingham Ozone Season Wind Rose

Birmingham has a humid subtropical climate characterized by hot summers, mild winters, and abundant rainfall. Precipitation is relatively well-distributed throughout the year, with March being the wettest month on average, and October the driest. Snow occasionally falls during winter, but many winters pass with no snow or only a trace. The spring and fall months are pleasant but variable as cold fronts frequently bring strong to severe thunderstorms and occasional tornadoes to the region. The fall season (primarily October) features less rainfall and fewer storms, as well as lower humidity than the spring, but November and early December represent a secondary severe weather season.

Based on the 30 year wind rose, the predominant wind directions occur from the north. Ozone is most likely to reach unhealthy levels on hot sunny days with light winds and low humidity in urban environments. Birmingham's ozone typically is highest in the summer under a north east wind.

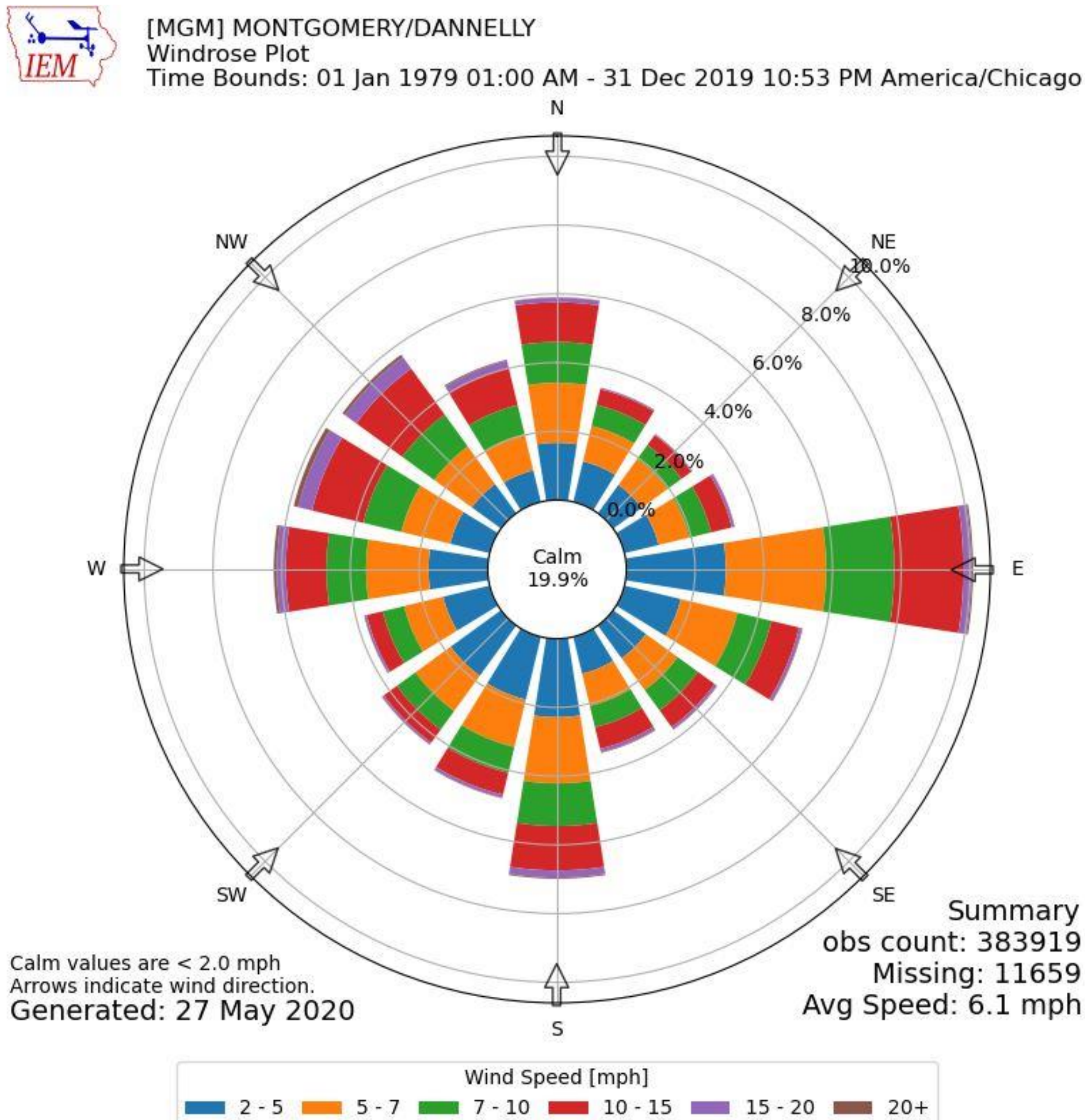


Figure 11 Montgomery 30 Year Wind Rose

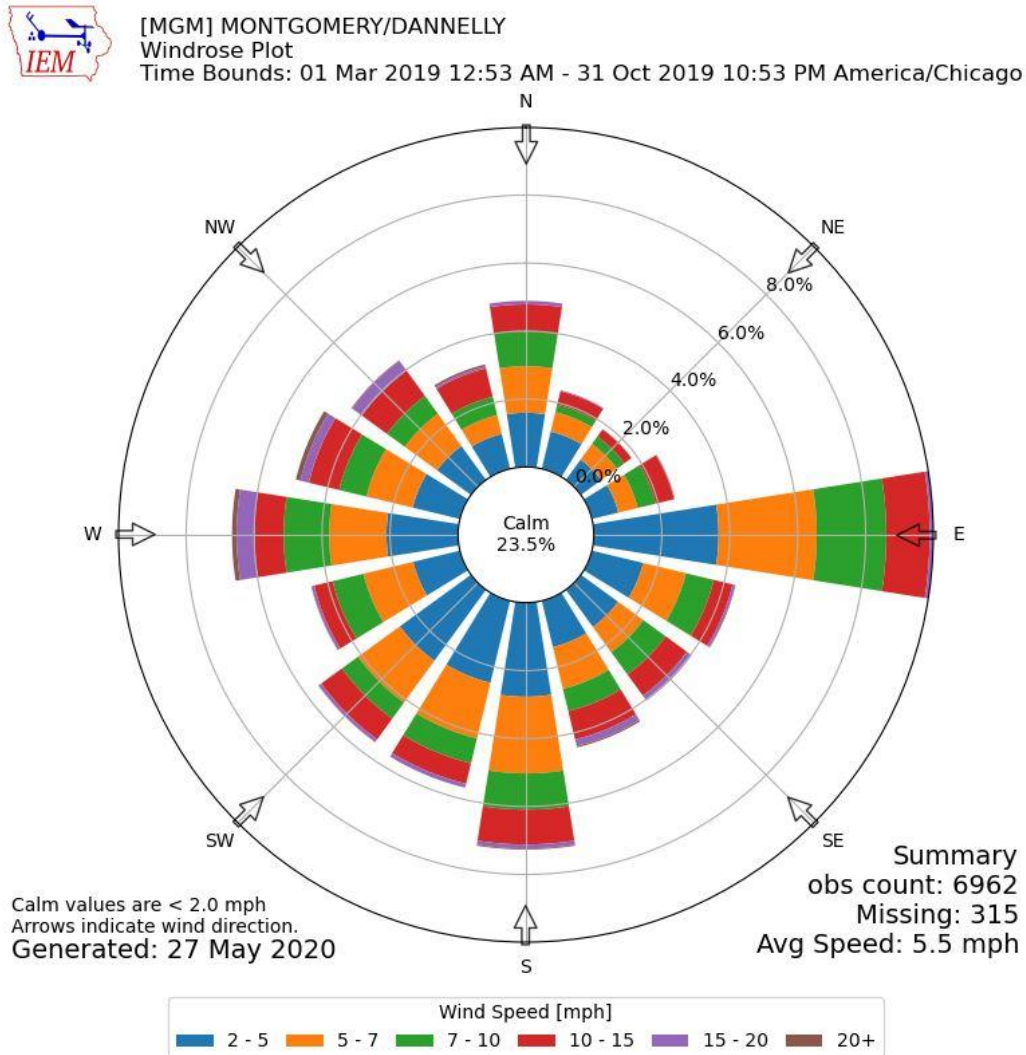


Figure 12 Montgomery Ozone Season Wind Rose

Montgomery has a humid subtropical climate, with short, mild winters, warm springs and autumns, and long, hot, humid summers. Summer afternoon heat indices, much more often than the actual air temperature, are frequently at or above 100 °F. Rainfall is well-distributed throughout the year, though February, March and July are the wettest months, while October represents the driest month. Snowfall occurs rarely during the winter, and even then it is usually light. Thunderstorms bring much of Montgomery's rainfall. These are common during the summer months but occur throughout the year. Based on the 30 year wind rose, the predominant wind directions occur from the east.

Ozone is most likely to reach unhealthy levels on hot sunny days with light winds and low humidity. Montgomery's ozone typically is highest in the summer under a southerly wind.

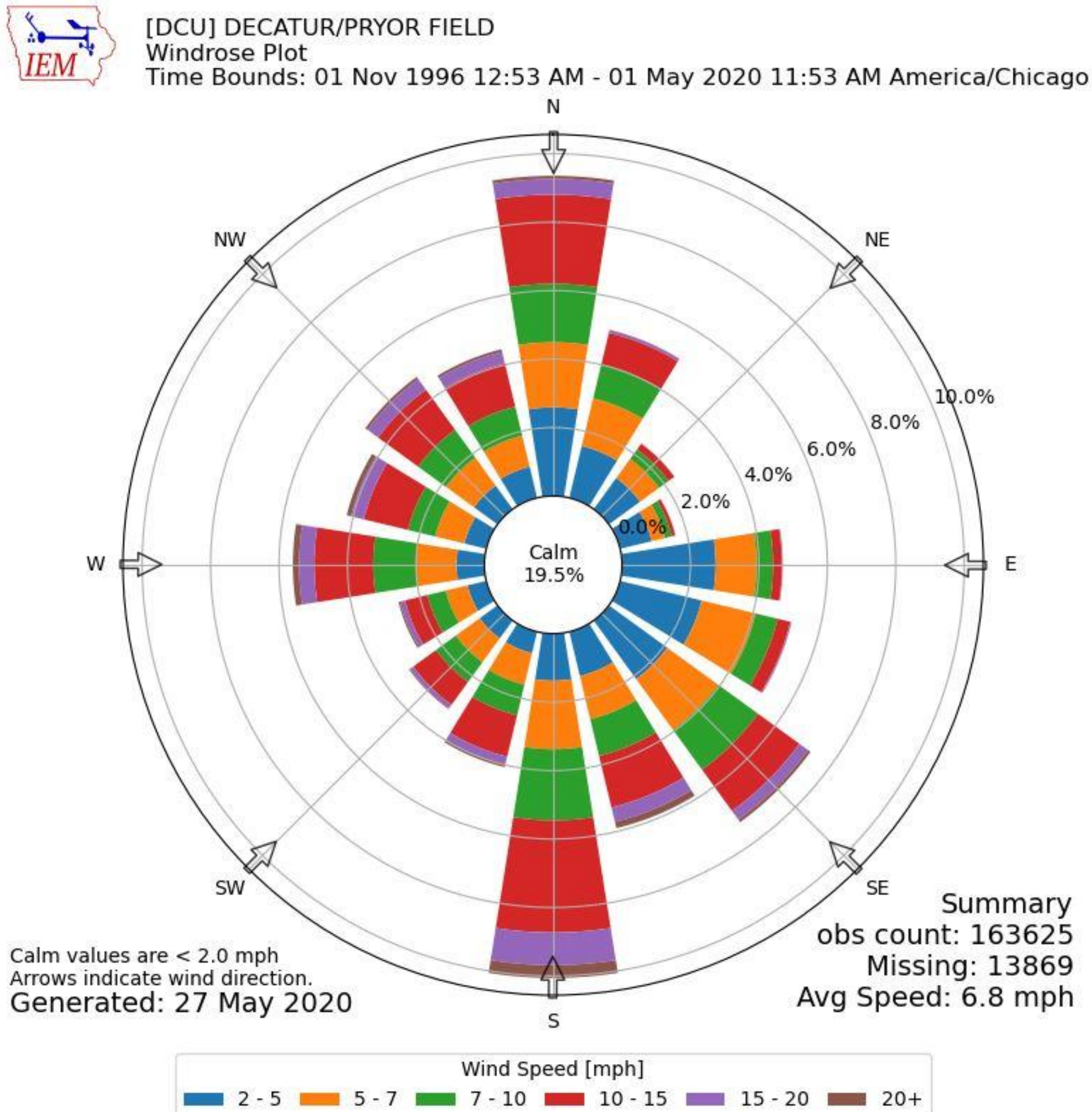


Figure 13 Decatur Wind Rose 11/1996-5/2020

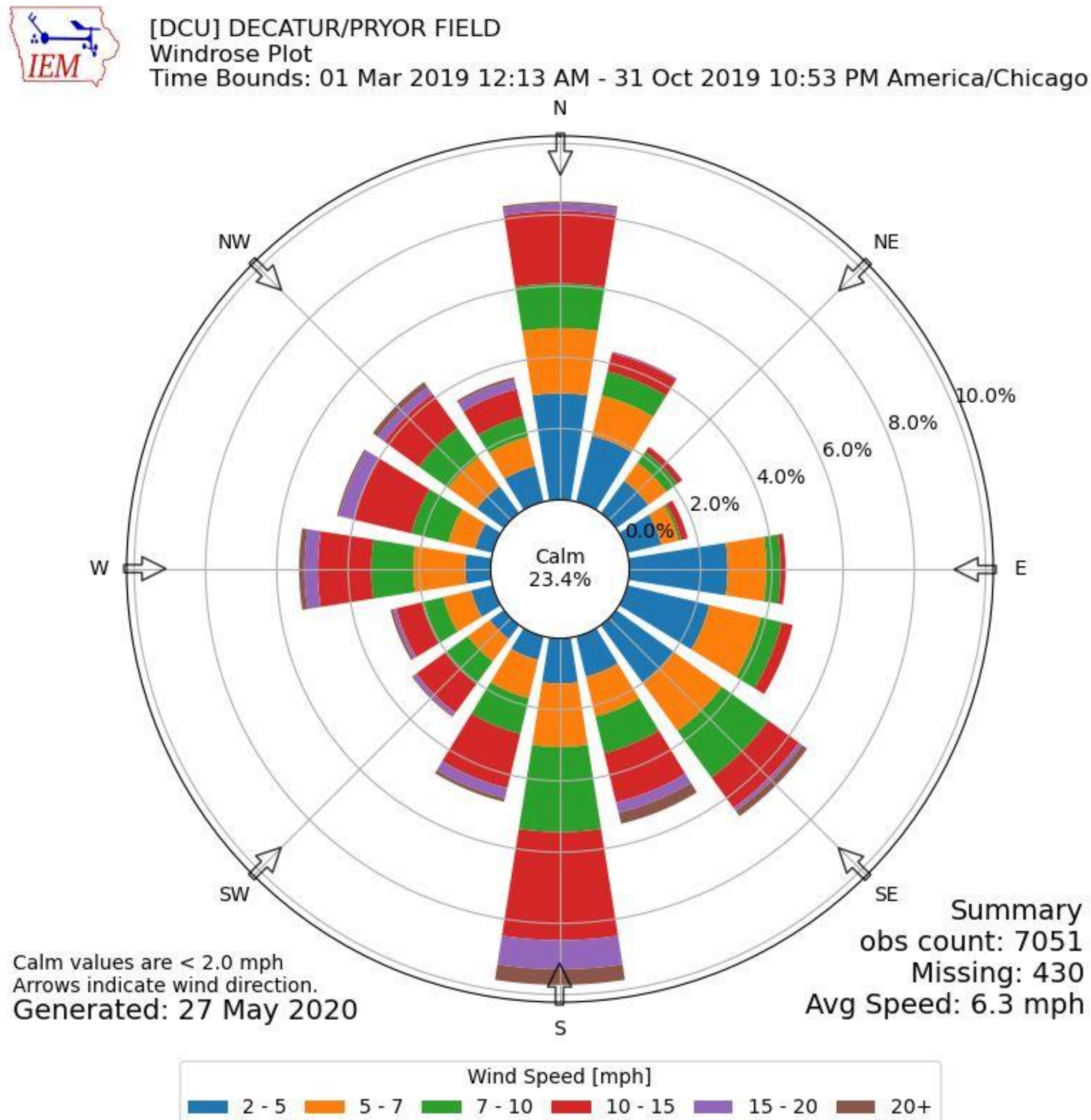


Figure 14 Decatur Ozone Season Wind Rose

Decatur has a humid subtropical climate with four distinct seasons. It experiences hot, humid summers and generally mild winters. Winters do not typically produce significant snowfall. A small, measurable amount of snow can be experienced a few times each year. Thunderstorms are common during the summer months. The latter part of summer tends to be drier. Autumn, which spans from mid-September to early-December, tends to be similar to spring in terms of temperature and precipitation, although the season begins relatively dry. Based on the 30 year wind rose, the predominant wind directions occur from both the north and south.

Ozone is most likely to reach unhealthy levels on hot sunny days with light winds and low humidity. Decatur's ozone typically is highest in the summer under a north east wind.

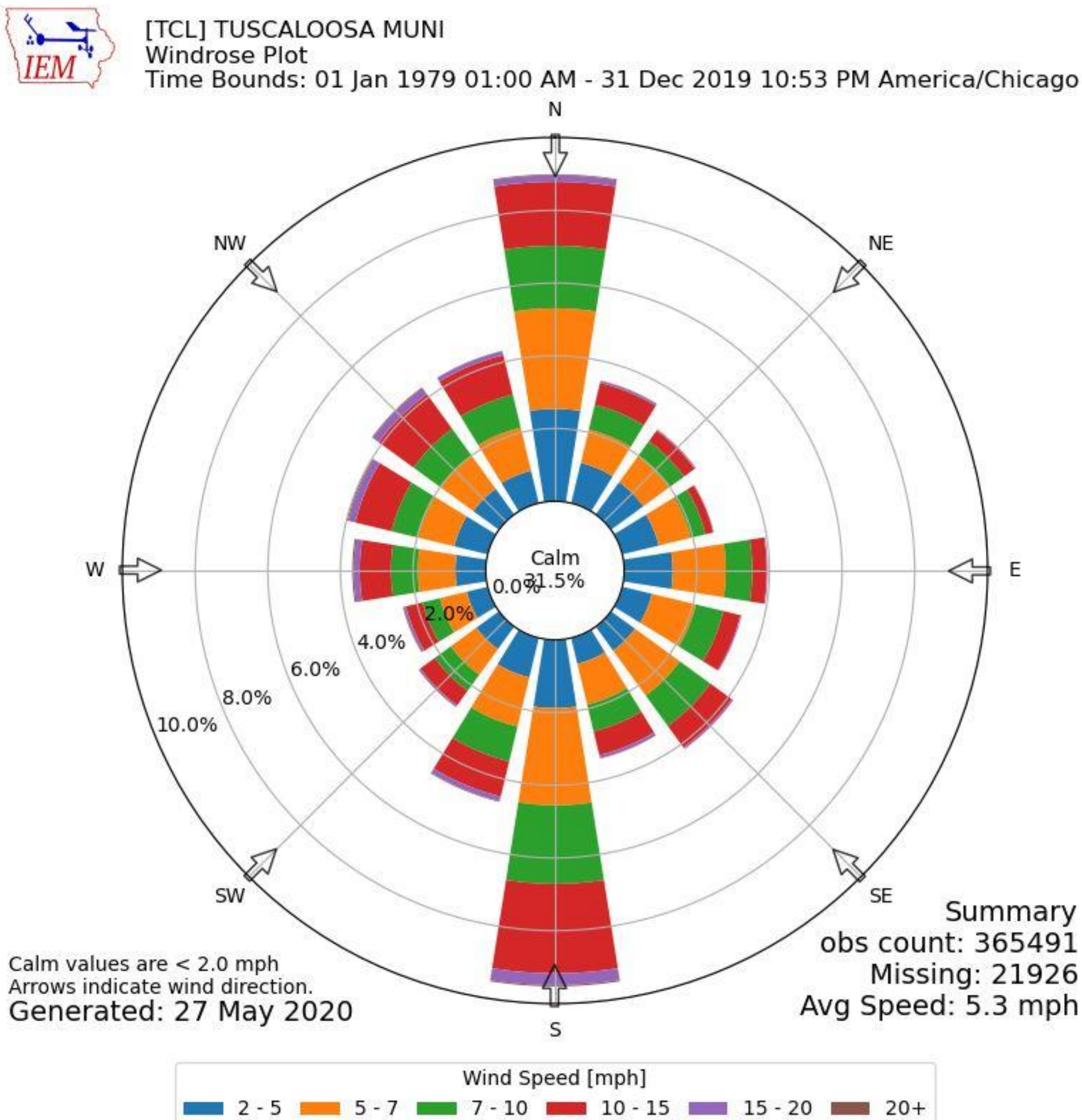


Figure 15 Tuscaloosa 30 Year Wind Rose

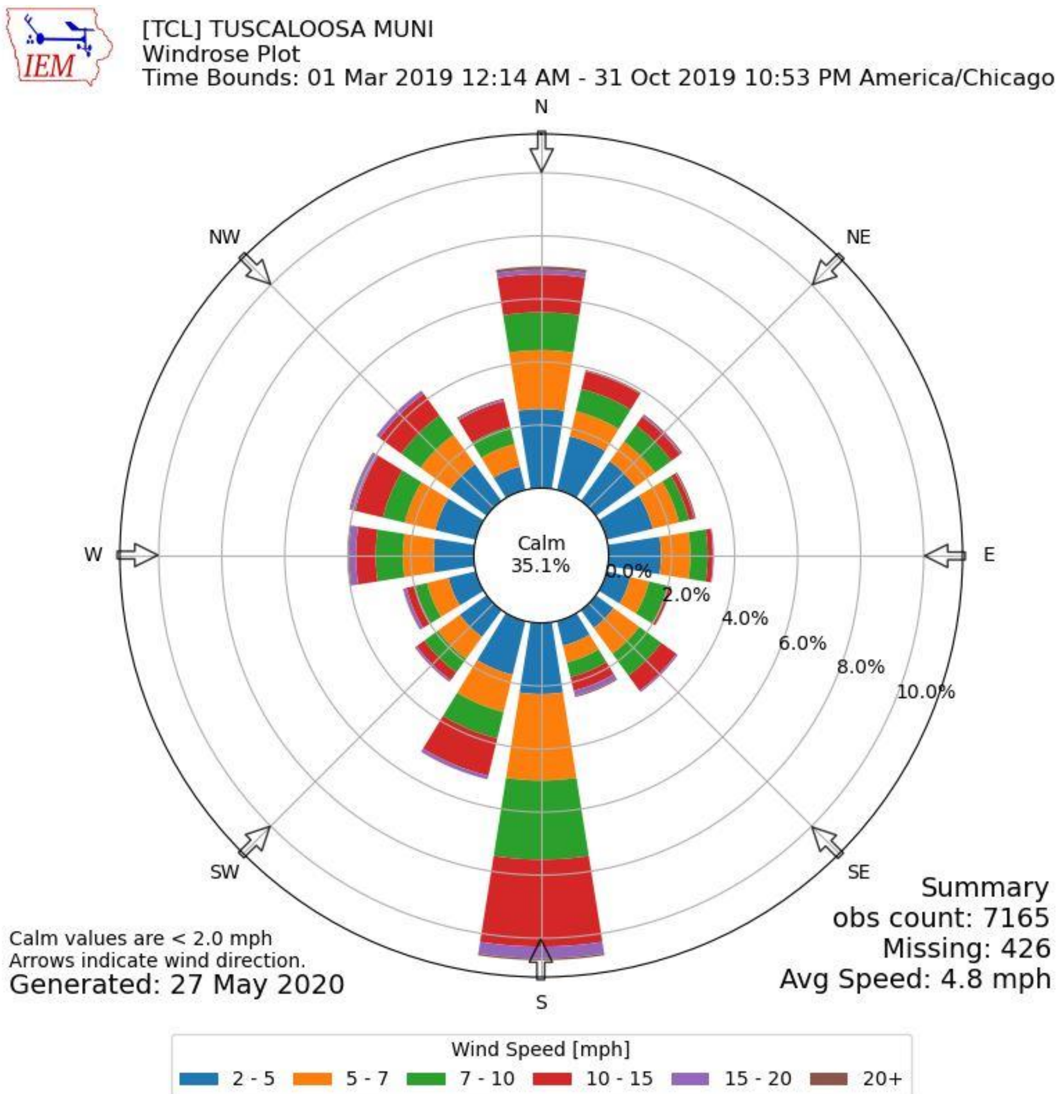


Figure 16 Tuscaloosa Ozone Season Wind Rose

Tuscaloosa has a humid subtropical climate characterized by hot summers, mild winters, and abundant rainfall. Precipitation is relatively well-distributed throughout the year, with March being the wettest month on average, and October the driest. Snow occasionally falls during winter, but many winters pass with no snow or only a trace. The spring and fall months can bring severe weather as cold fronts frequently bring strong to severe thunderstorms and occasional tornadoes to the region. The fall season (primarily October) features less rainfall and fewer storms, as well as lower humidity than the spring, but November and early December represent a secondary severe weather season.

Based on the 30 year wind rose, the predominant wind directions occur from both the north and south. Ozone is most likely to reach unhealthy levels on hot sunny days with light winds and low humidity. Tuscaloosa's ozone typically is highest in the summer under a north east wind.

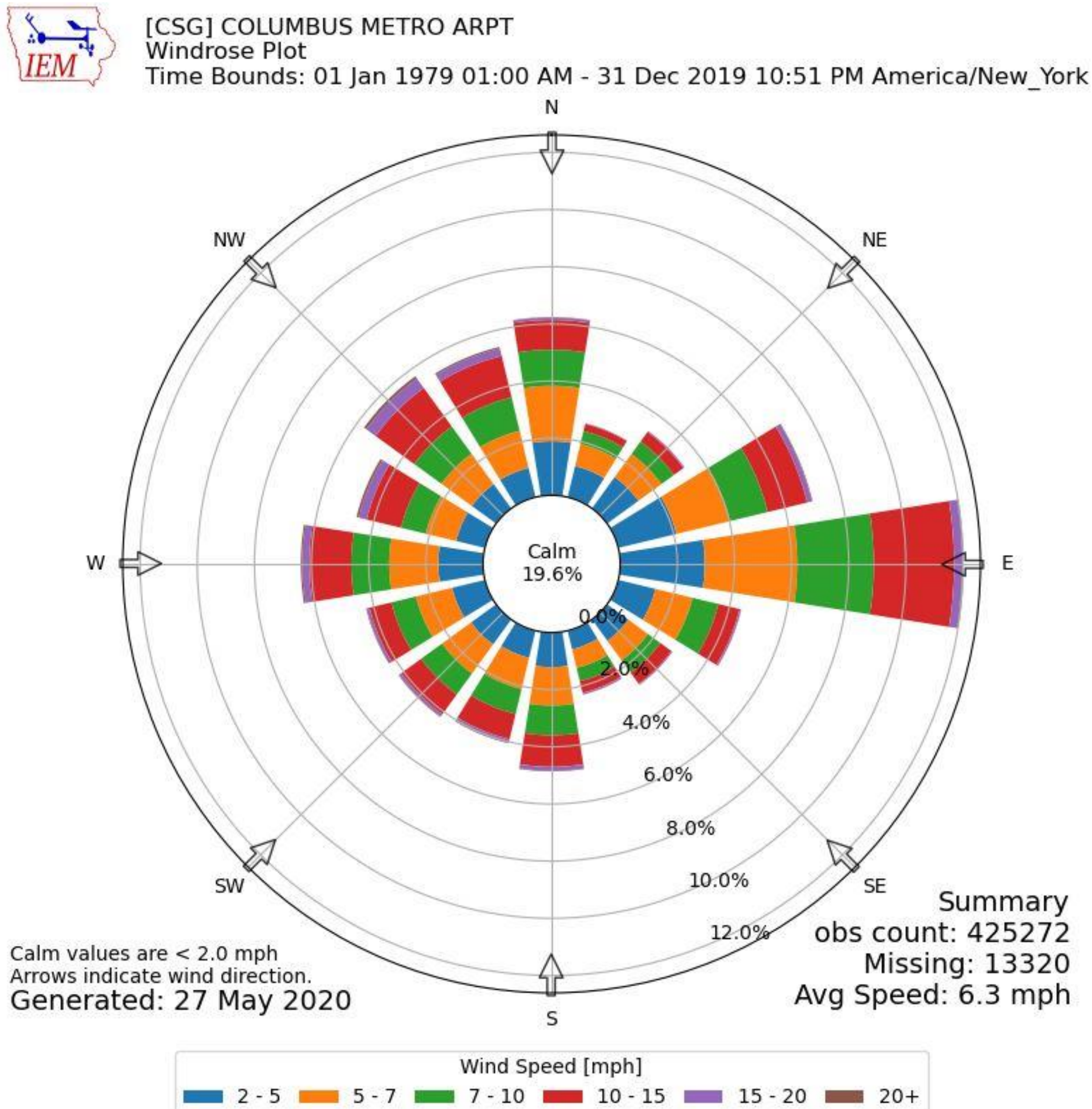


Figure 17 Columbus/Phenix City 30 Year Wind Rose

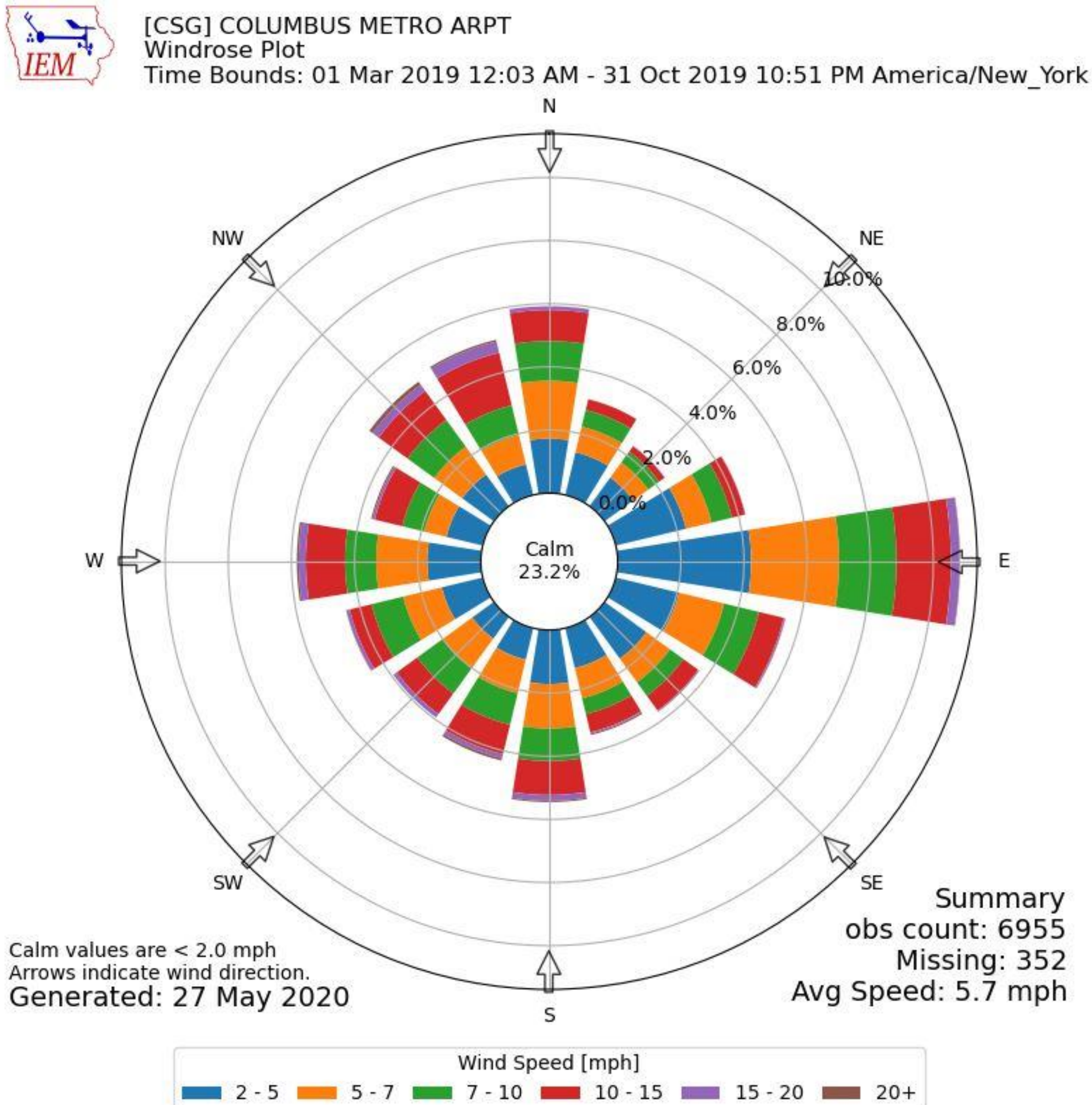


Figure 18 Columbus/Phenix City Ozone Season Wind Rose

Columbus has a humid subtropical climate, with short, mild winters, warm springs and autumns, and long, hot, humid summers. Summer afternoon heat indices, much more often than the actual air temperature, are frequently at or above 100 °F. Rainfall is well-distributed throughout the year, though February, March and July are the wettest months, while October is the driest month. Snowfall occurs only during some winters, and even then is usually light. Thunderstorms bring much of Columbus rainfall. These are common during the summer months, but can occur throughout the year. Based on the 30 year wind rose, the predominant wind directions occur from the east.

Ozone is most likely to reach unhealthy levels on hot sunny days with light winds and low humidity. Columbus ozone typically is highest in the summer under a south east wind.

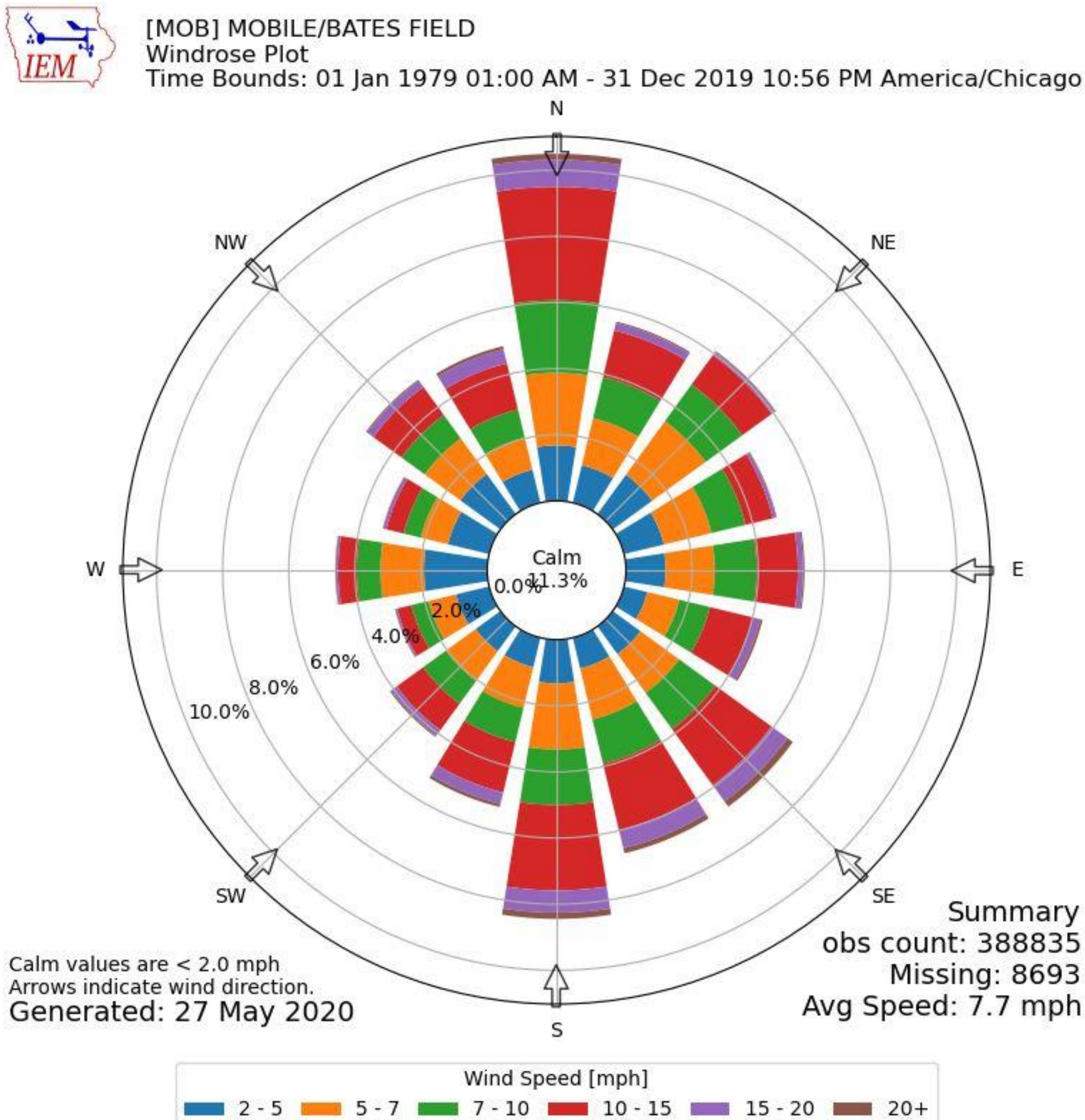


Figure 19 Mobile 30 Year Wind Rose

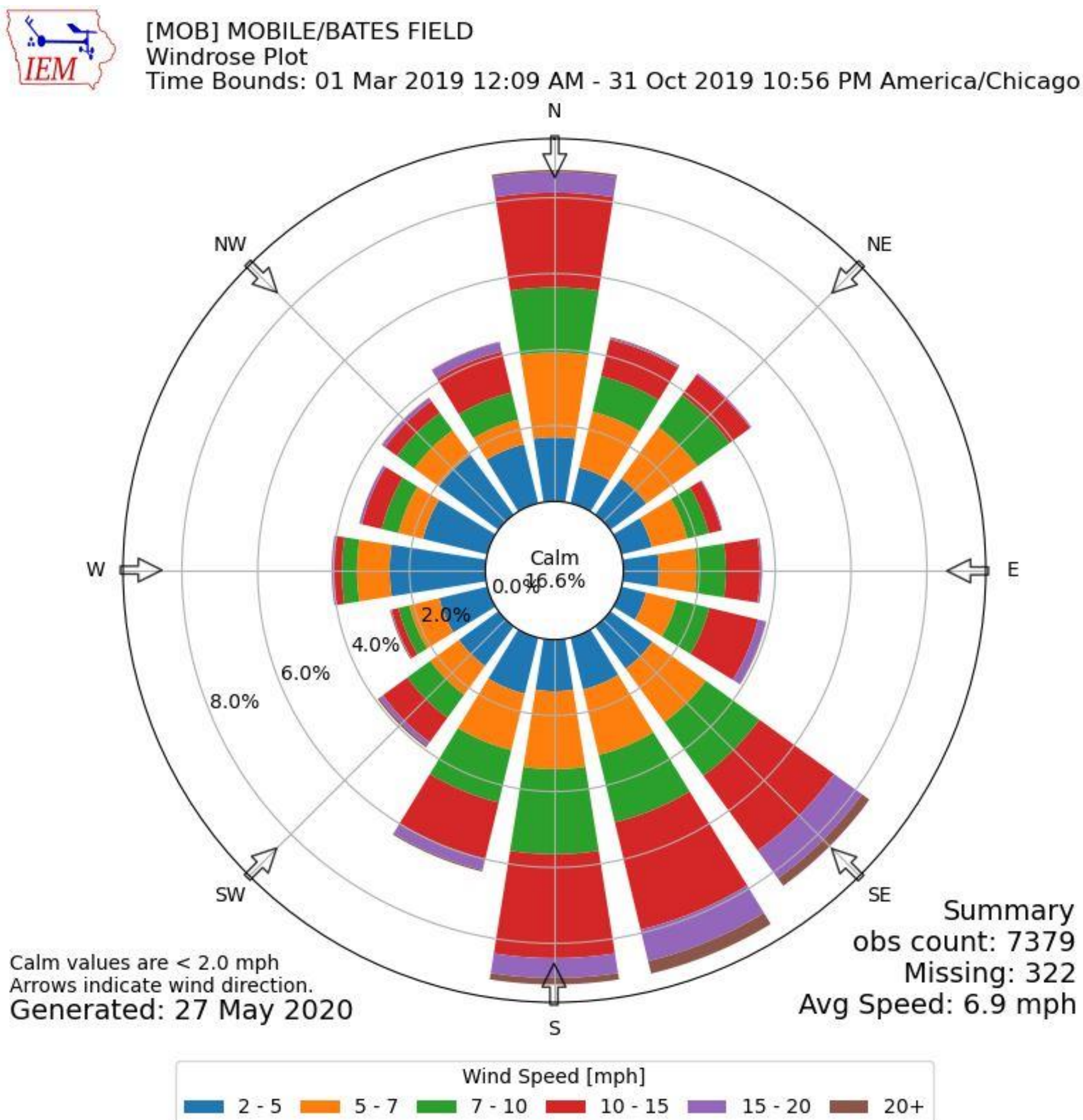


Figure 20 Mobile Ozone Season Wind Rose

Mobile's geographical location on the Gulf of Mexico provides a mild subtropical climate with hot, humid summers and mild, rainy winters. It has been determined that Mobile is one of the wettest cities in the contiguous 48 states, with 66.3 inches of average annual rainfall over a 30 year period. Precipitation is heavy year-round. On average, July and August are the wettest months, with frequent heavy rain showers and thunderstorm activity. October stands out as a slightly drier month than all others. Based on the 30 year wind rose, the predominant wind directions occur from the north.

Ozone is most likely to reach unhealthy levels on hot sunny days with light winds and low humidity in urban environments. Mobile's ozone typically is highest in the summer under a westerly wind.

Ozone

The ozone monitoring network as it currently exists is described in the 2020 Ambient Air Monitoring Plan. Table 3 below presents a matrix of the current ozone monitors in the network and attempts to ascribe the relative importance of each monitor to the network. Since the most important ranking factors for ozone monitoring are the ability to determine NAAQS attainment status and whether the monitor is required by Appendix D, a value of 30 or greater was determined to be highly important to the network. All of the monitors in the network ranked 20 or greater.

Updates to Ozone Monitoring since the last network assessment

Since the last Network Assessment, the level of the ozone NAAQS was lowered to 0.070 ppm. The form of the standard remains the same: the 3-year average of the annual fourth-highest daily maximum 8-hour average O_3 concentration is compared to the NAAQS. The interpretation of the NAAQS in 40CFR part 50, Appendix U was modified at the same time to change the hours used to determine a valid daily max. Because of the change, nearly all of ADEM's ozone sites are now required by Appendix D.

The quality assurance regulations in 40 CFR 58, Appendix A were updated in March, 2018.

No additional changes to the NAAQS or monitoring regulations have been proposed at this time.

Summary of Changes to the Ozone Monitoring Network 2016 -2019

The Montgomery MSA is represented by two ozone monitoring sites due to the size of the population. While the Montgomery site (AQS ID 01-101-1002) had no changes, ADEM's DBT (AQS ID 01-051-1001) ozone monitoring site had to be moved in June 2016 due to loss of access to the site. The site was moved to 206 Queen Ann Road, Wetumpka, Alabama and assigned AQS ID 01-051-1003. A monitor operated at that location for one ozone season but ADEM lost site access and again had to relocate. The site was moved to 3148 Elmore Road, Wetumpka, Alabama and assigned AQS ID 01-051-0004. Ozone monitoring began March 21, 2018 and is currently monitoring at this location.

At the Muscle Shoals site (AQS ID 01-033-1002), as approved in the 2019 network plan, O_3 monitoring was discontinued at the end of the season on October 31, 2019, and the site was shut-down.

At the Dothan site (AQS ID 01-069-0004), as approved in the 2019 network plan, O_3 monitoring was discontinued at the end of the season on October 31, 2019, and the site was shut-down.

South Girard School (AQS ID 01-113-0003) combined monitoring from two separate sites: Phenix City-Downtown particulate matter monitoring site (AQS ID 01-113-0001) and Phenix City-Ladonia ozone monitoring site (AQS ID 01-113-0002). All ambient air monitoring activities in the Phenix City area were consolidated to one location at the South Girard School at 510 6th Place, Phenix City. Ozone monitoring began at this location on March 1, 2018.

Discontinuation of low value monitoring sites and consolidation of multiple sites to a multi-pollutant site has enabled ADEM to apply these resources to shelter replacement and technology upgrades.

The Current Ozone Network

The current network is described in detail in the 2020 ADEM Network Plan available for review at the following website: [2020 ADEM Annual Network Plan]

There are four agencies that monitor ozone in Alabama. There are two local programs, JCDH and HDNREM, ADEM and the US EPA operates a special site as part of the CASTNET program. Each program is a separate Quality Assurance Organization and prepare independent annual plans and 5-year assessments.

CASTNET is a long-term, rural monitoring network used to assess the environmental results due to emission reduction programs and pollutant impacts to sensitive ecosystems and vegetation. Ozone monitors meet the requirements of Title 40 of the Code of Federal Regulations (CFR) Part 58 and are used to determine compliance with the NAAQS for O_3. The network reports trends in pollutant concentrations and acidic deposition. Data from CASTNET also support the assessment of the primary and secondary National Ambient Air Quality Standards (NAAQS) for ozone (O_3), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2). Additionally, the National Park Service and Bureau of Land Management utilize CASTNET data for assessing critical loads exceedances in sensitive ecosystems (i.e., high elevation and coastal sites) and applications related to permitting. CASTNET also features measurements of trace-level gases at select sites. Additional information can be found at the CASTNET website. (https://www.epa.gov/castnet) A CASTNET monitor is located at Sand Mountain near Crossville.

A map of the current ozone monitoring locations is found in Figure 22. Table 3 represents an evaluation of the relative importance of the ozone sites in the ADEM Network. A value greater than 30 indicates the site is of high value and should remain. A value between 20 and 30 indicates the site is of general benefit to the network and should remain. A value below 20 may indicate a low value site.

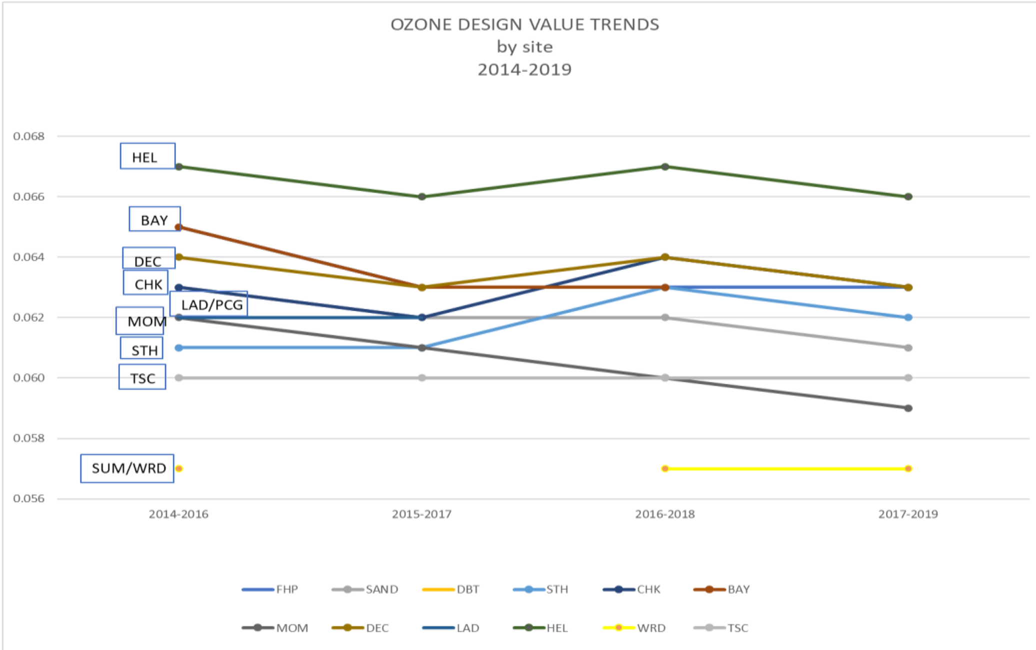


Figure 21 Ozone Design Value Trends

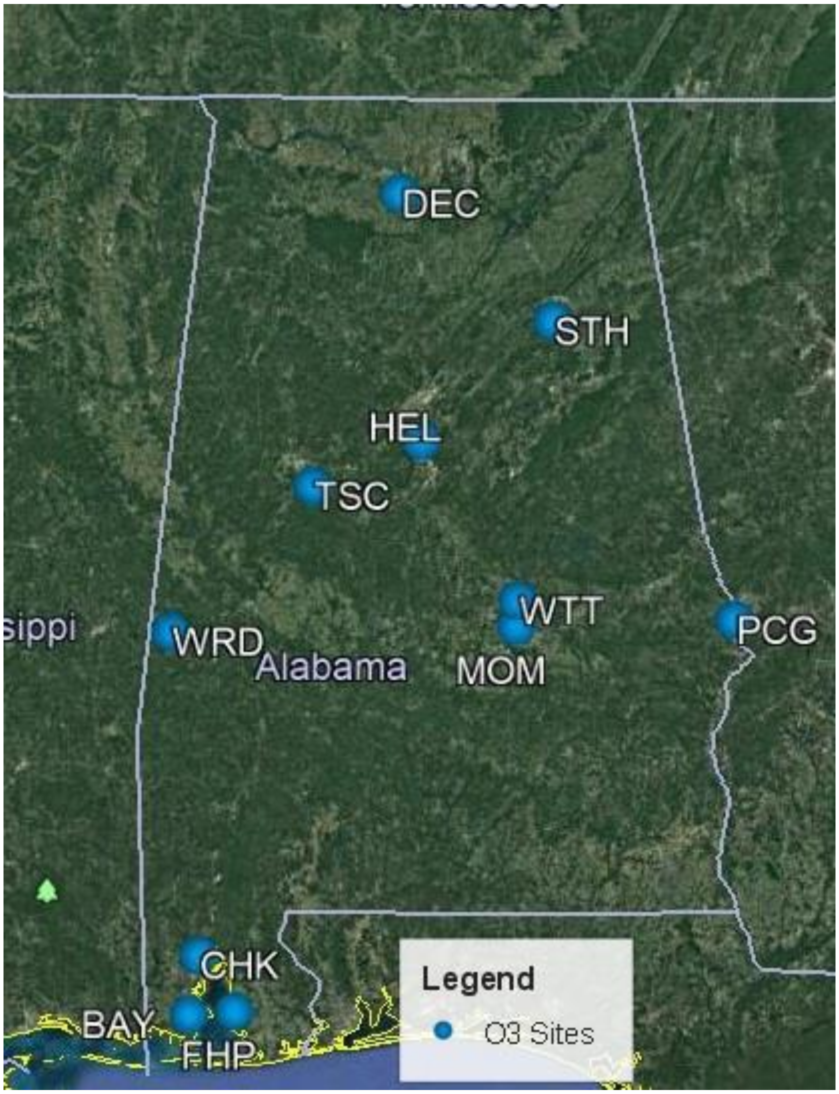


Figure 22 Map of Existing ADEM Ozone Monitors

Table 3 Ozone Monitor Rank Matrix

ADEM SITE COMMOM NAME	potential rank value	Fairhope	Wetumpka Tech. Park	Southside	Chickasaw	Bay Road	MOMS	Decatur	Phenix City - Girard	Helena	Ward	Tuscaloosa Co.	Sand Mountain
ADEM Abbreviation		**FHP**	**WTT**	**STH**	**CHK**	**BAY**	**MOM**	**DEC**	**PCG**	**HEL**	**WRD**	**TSC**	**SAND**
AQS county code		003	051	055	097	097	101	103	113	117	119	125	149
AQS Site ID Number		0010	0004	0011	0003	2005	1002	0011	0003	0004	0003	0010	9991
Appendix D required	15	15	15	15	15	15	15	15	15	15	15	15	
Potential to exceed NAAQS	5												
Ozone NAAQS Probability	10	10	10	10	10	10	10	10	10	10	10	10	10
Attainment History	5												
Located in complex terrain	5									5			
Used for AQI reporting	3	3	3		3	3	3		3	3			
Fills spatial needs for Airnow reporting	3	3	3	3	3	3	3	3	3	3	3	3	
Used in outside studies	10												10
Located in unique areas	5												
Background monitor	5										5		5
Transport monitor	5	5											
Community concerns	10	10				10							
Forecasting	10	10	10		10	10	10	10	10	10			
Total	91	56	41	28	41	51	41	38	41	46	33	28	25

NOTE: NAAQS probability refers to the site closure analysis in Table 5.

Area Served Analysis

The area served tool uses a spatial analysis technique known as Voronoi or Thiessen polygons to show the area represented by a monitoring site. The shape and size of each polygon is dependent on the proximity of the nearest neighbors to a particular site. All points within a polygon are closer to the monitor in that polygon than to any other monitor. Once the polygons are calculated, data from the decennial census are used to find the census tract centroids within each polygon. The population represented by the polygon is calculated by summing the populations of these census tracts.

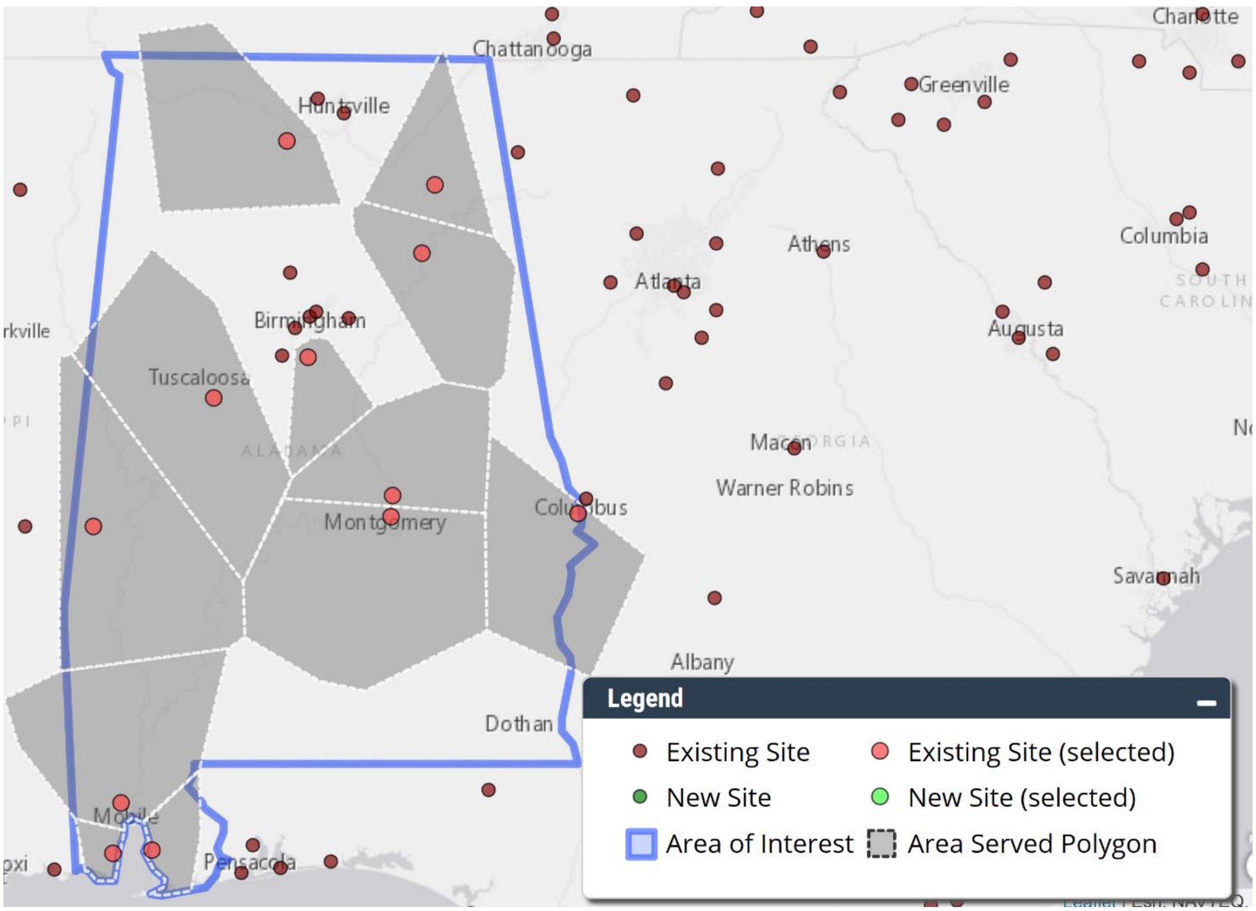


Figure 23 Statewide Area Served Voronoi Polygons

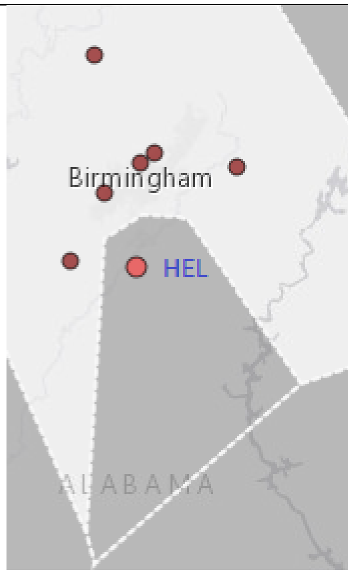


Figure 24 Area Served Map of Birmingham MSA

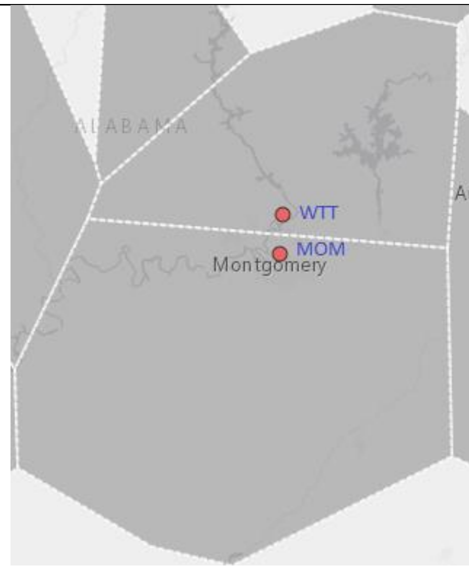


Figure 25 Area Served Map of the Montgomery MSA

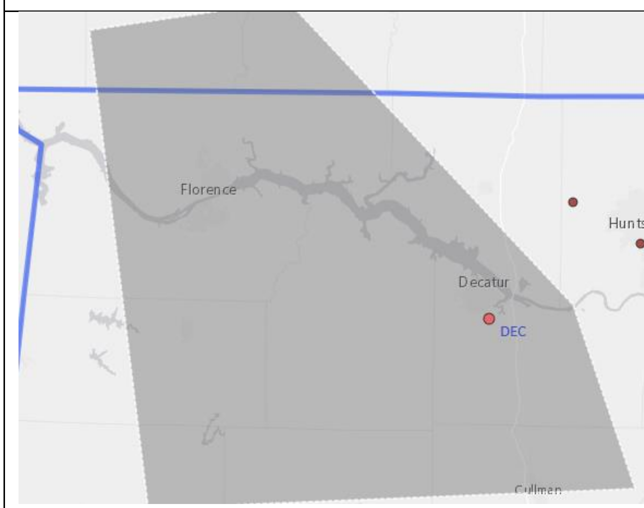
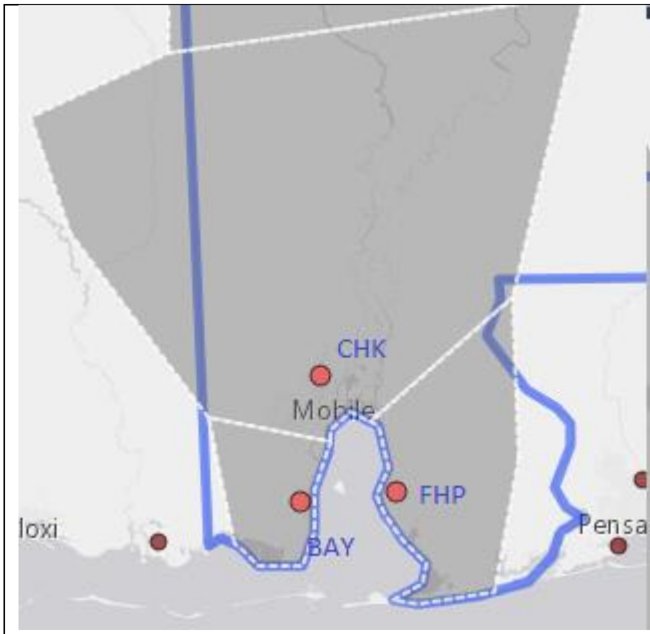


Figure 26 Area Served Map of the Decatur MSA

Figure 27 Area Served Map of the Columbus, GA-Phenix City, AL MSA

 **Figure 28 Area Served Map of the Mobile and Fairhope MSAs**	 **Figure 29 Area Served Map of Northeast Alabama**

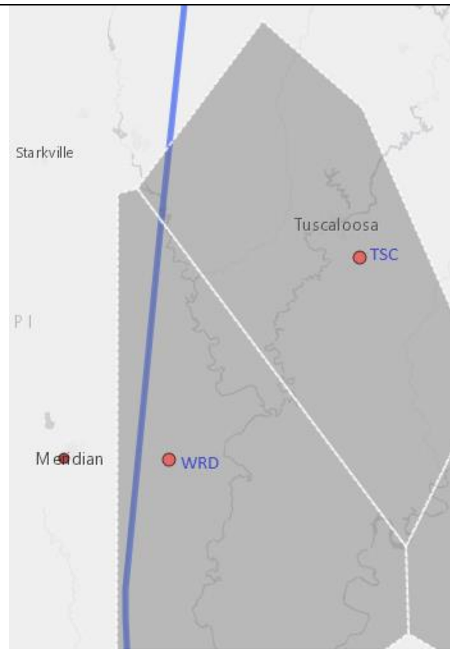


Figure 30 Area Served Map of West Alabama

Using the area served maps and Table 4 below, it is indicated that 61 percent of Alabama's population is served by monitors operated by ADEM. Of the remainder, approximately 20 percent of Alabama's population is found in Jefferson and Madison Counties which operate separate monitoring networks.

It is noted that the Voronoi polygons represent a purely mathematical construct based on the proximity of sites to each other, important factors which would aid in determining the area and population served by a monitor such as emissions, meteorology and topography are not being considered.

Table 4 Population and Area Represented in Voronoi Polygons

AQS Site ID	Site Name	County Name	Area (km^2)	Ozone Exceedance Probability	Total Population
10030010	Fairhope, Alabama	Baldwin	2,059	<10%	128,158
10970003	Chickasaw	Mobile	11,012	<10%	404,449
10972005	Bay Road	Mobile	729	<10%	96,761
11011002	Moms, ADEM	Montgomery	15,168	<10%	411,478
11030011	Decatur, Alabama	Morgan	9,548	<10%	389,653
11170004	Helena	Shelby	2,351	<10%	257,514
11250010	Duncanville, Tuscaloosa	Tuscaloosa	13,721	<10%	288,633
10550011	Southside	Etowah	7,807	<10%	299,555
10499991	Crossville, Sand Mountain	DeKalb	4,749	<10%	179,737
11190003	Ward, Sumter Co.	Sumter	12,782	<10%	84,283
11130003	Phenix City - South Girard School	Russell	9,596	<10%	291,275
10510004	Wetumpka Westside Technology Park	Elmore	6,898	<10%	163,350
Aggregated					
	Total ADEM Served		96,420		2,994,846
	Alabama		135,764		4,903,185
	Percentage of Alabama		71%		61%

Population

Population is one component used by Appendix D to determine the number of required ozone monitors. The other factor is the design value. There are 13 MSAs in Alabama that meet the Appendix D requirements for population. Each MSA is discussed in detail in the 2020 AAQMP Annual Network Plan. Ten of the 12 ozone monitor locations are located in MSAs. The maps in Figure 4 and Figure 5 indicate that these monitors are located in the areas of highest and increasing population. Outside of the MSAs, regional monitors are located in Ward and the CASTNET site at Crossville.

Within the Montgomery MSA, a monitor is located close to the Montgomery downtown area (MOMS, AQS ID 01-101-1002) and an additional monitor is located in Elmore County (AQS ID 01-051-0004) in an area of high population growth and within a neighborhood that is representative of other outlying neighborhoods.

Figure 5 shows that most of the growth in the Mobile area has been in Baldwin County. Mobile and Fairhope are now both metropolitan areas and are considered separately in Appendix D. There are two ozone monitors in Mobile County to the north and south of the central business district and there is a monitor located in Baldwin County in the Fairhope MSA.

The Birmingham MSA has experienced highest growth in the north Shelby County area (Figure 5). The JCDH has monitors in the Birmingham urban area and in outlying areas around Jefferson County. In addition, ADEM operates a monitor in north Shelby County in a neighborhood representative of other high growth areas.

Emissions

When considering the suitability of monitor locations, emissions of relevant pollutants should be considered. The location of the emissions along with the local meteorology will determine the most suitable locations. For ozone (O_3), nitrogen oxide (NO_x) and volatile organic compounds (VOCs) emissions were plotted on maps in Figure 31 and Figure 32.

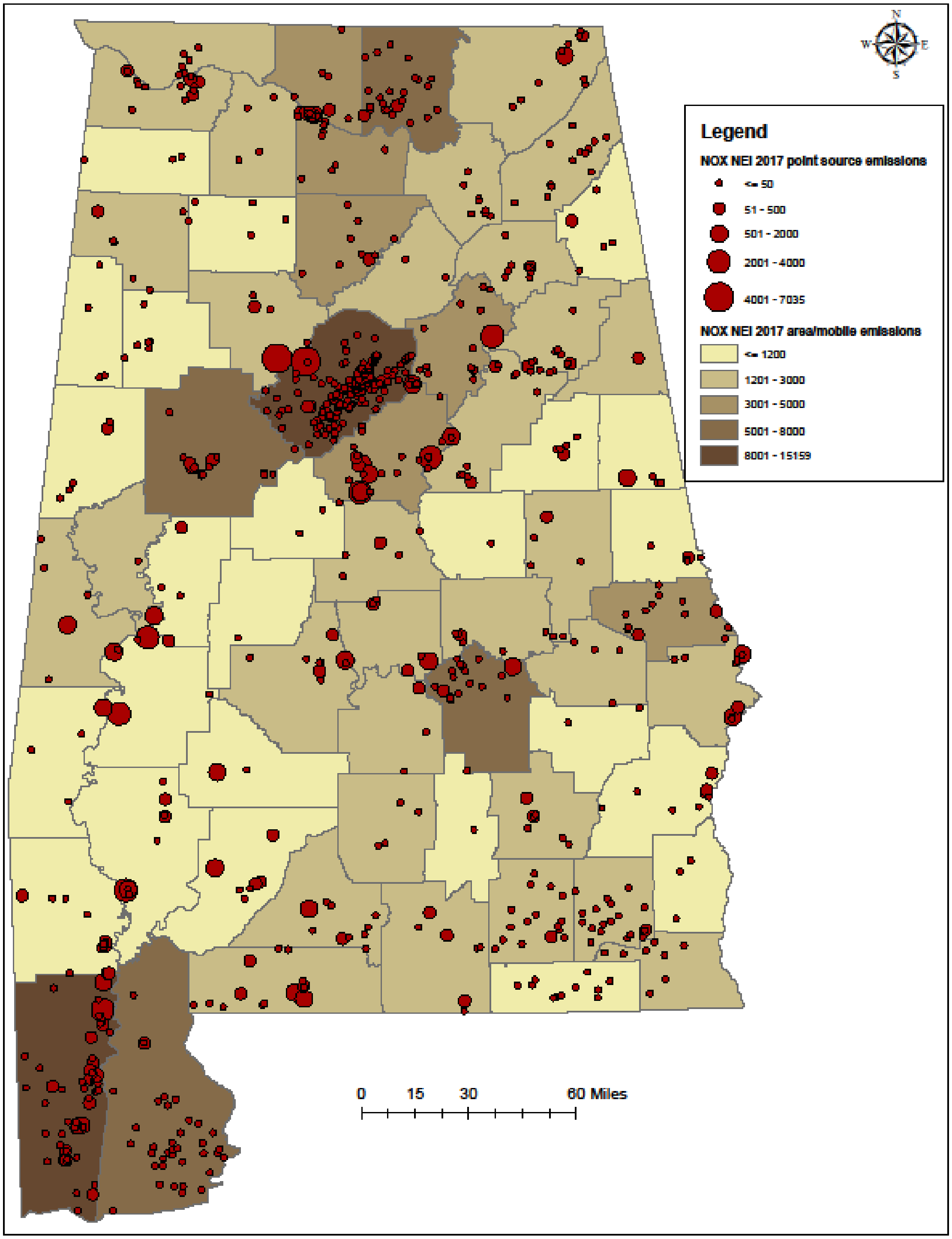


Figure 31 Statewide NOx Emissions

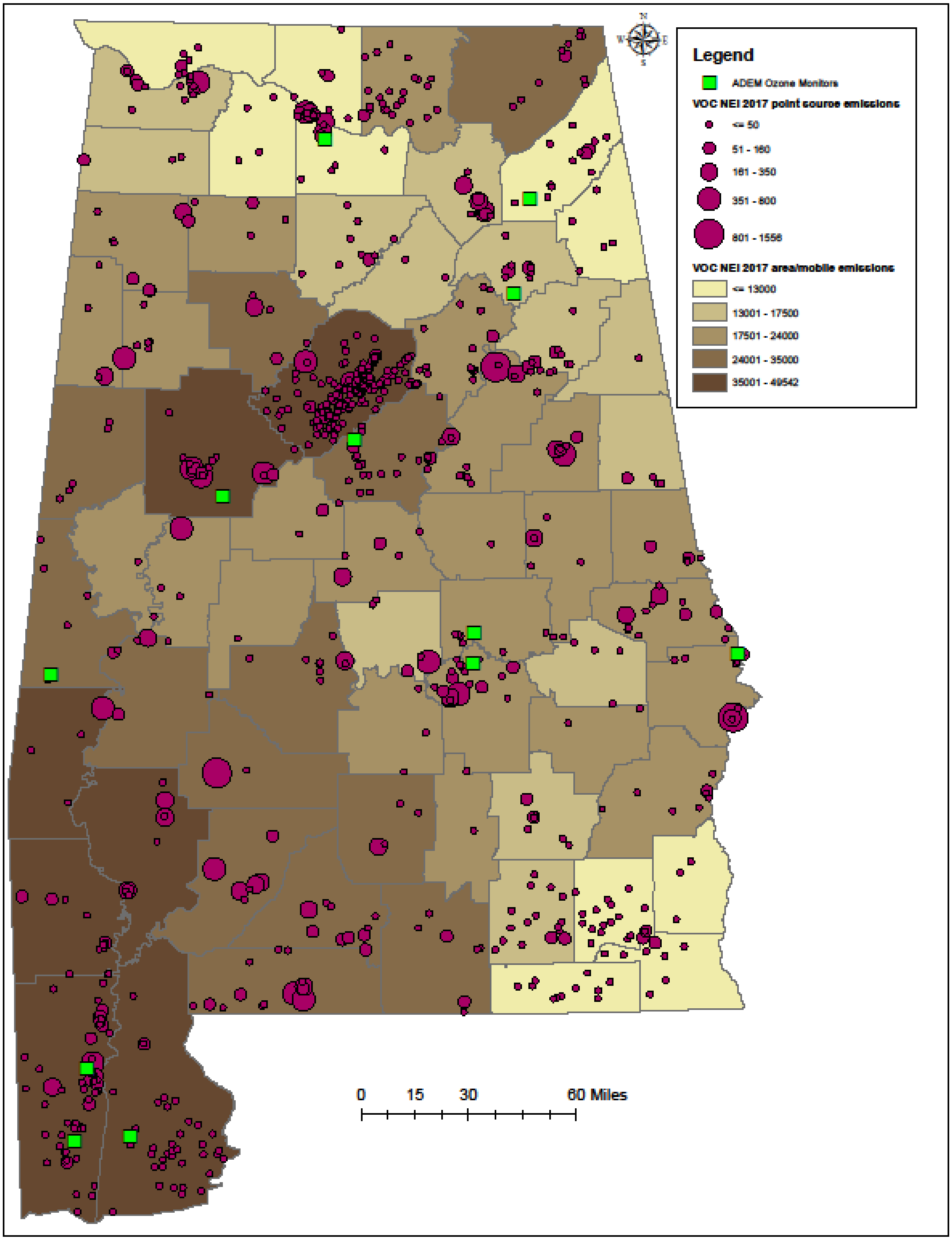


Figure 32 Statewide VOC Emissions with Ozone Monitor Locations

Site Correlation and Removal

A site correlation matrix was created using the EPA Network Assessment Tools. It is presented in Figure 33. This matrix can show sites with a high correlation in their data which can be indication of redundancy. Usually, sites with a larger distance between them will generally be more poorly correlated and have large differences in the corresponding pollutant concentrations. Lighter shading indicates closer correlation.

For example, the two Mobile County sites have a strong correlation to each other and to the Baldwin County site. In this case, the two Mobile sites are required due to the population of the county and they are located to the north and south of the main business area and the emission sources. This also correlates to the two major wind directions in the area. This combination adequately represents the second largest MSA in the state. The Fairhope monitor is not redundant because it is located in a separate MSA and is representative of the conditions in that MSA.

Another pair of monitors that seem to have close correlation is the Southside monitor and EPA's Sand Mountain Monitor. While these monitors are relatively close together (43Km) they have very different objectives. The Sand Mountain monitor is located in a rural area and is part of the CASTNET network of monitors. The Southside monitor objective is to represent the highest concentration in the Gadsden MSA.

The monitors in the Montgomery MSA also show high correlation but both monitors are required by Appendix D to provide representative data.

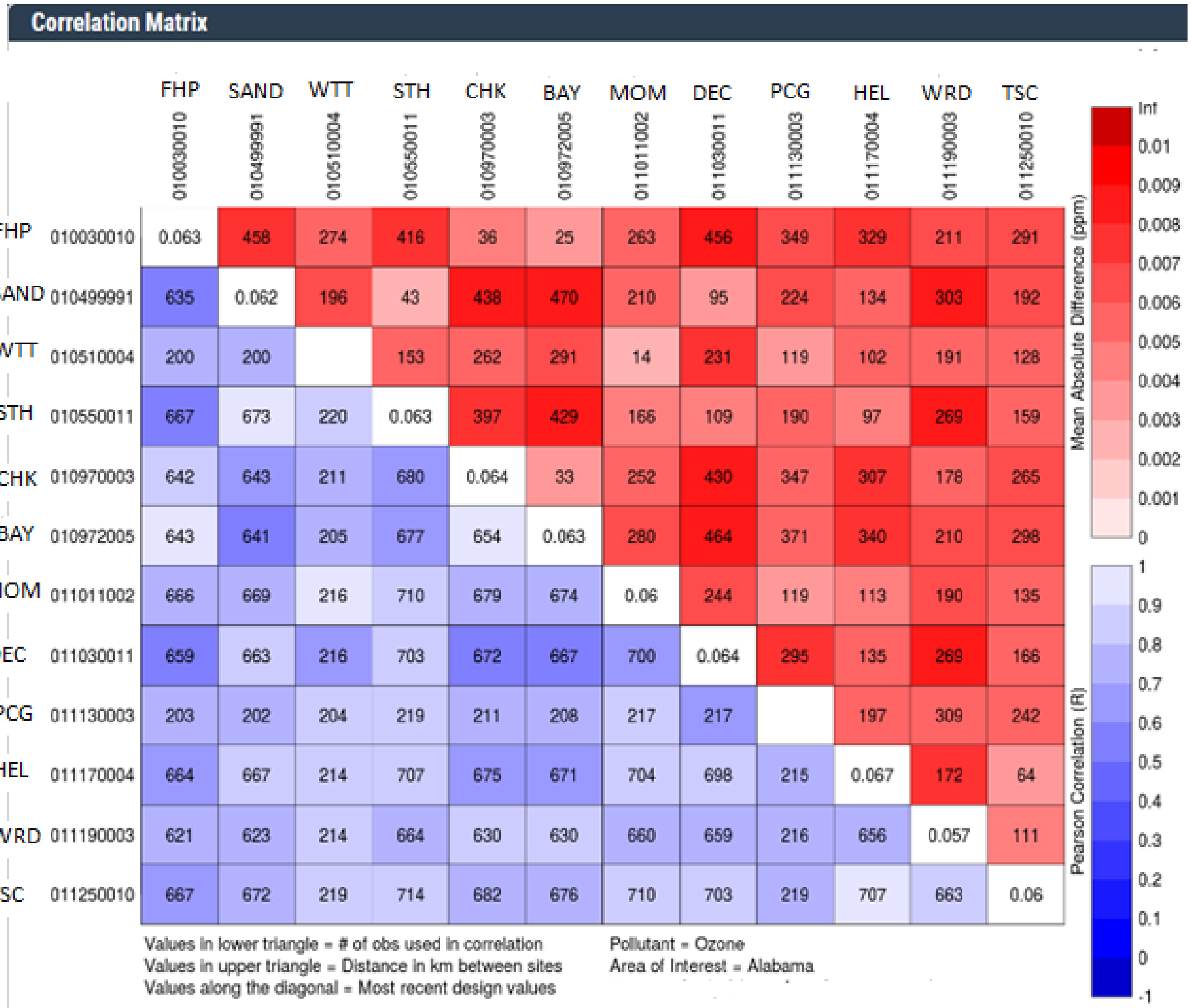


Figure 33 Statewide Ozone Site Correlation Matrix

Site closure analysis

Table 5 Ozone Site Closure Analysis

	FHP	WTT	SAND	STH	CHK	BAY	MOM	DEC	PHC	HEL	WRD	TSC
2008-2010	0.071		0.070	0.063	0.072	0.073	0.068	0.066	0.067	0.074		0.061
2009-2011	0.072		0.067	0.062	0.070	0.073	0.068	0.067	0.066	0.072		0.058
2010-2012	0.071		0.069	0.062	0.071	0.072	0.069	0.071	0.067	0.075		0.059
2011-2013	0.067		0.066	0.061	0.066		0.065	0.068	0.065	0.073		0.059
2012-2014	0.066		0.065	0.060	0.065		0.063	0.065	0.062	0.068		0.058
2013-2015	0.065		0.063	0.059	0.062	0.065	0.062	0.061	0.061	0.065	0.057	0.059
2014-2016	0.065		0.063	0.061	0.063	0.065	0.062	0.064	0.062	0.067	0.057	0.060
2015-2017	0.063		0.062	0.061	0.062	0.063	0.061	0.063	0.062	0.066	0.056	0.060
2016-2018	0.063		0.062	0.063	0.064	0.063	0.060	0.064	0.062	0.067	0.057	0.060
2017-2019	0.063	0.058	0.061	0.062	0.063		0.059	0.063	0.061	0.066	0.057	0.060
Average Design Value	**0.067**	**0.058**	**0.065**	**0.061**	**0.066**	**0.068**	**0.064**	**0.065**	**0.064**	**0.069**	**0.057**	**0.059**
n	**10**	**1**	**10**	**10**	**10**	**7**	**10**	**10**	**10**	**10**	**5**	**10**
student's t	**1.83**	**#N/A**	**1.83**	**1.83**	**1.83**	**1.94**	**1.83**	**1.83**	**1.83**	**1.83**	**2.13**	**1.83**
stdev.S	0.004	NSD	0.003	0.001	0.004	0.005	0.004	0.003	0.002	0.004	0.000	0.001
Probability	0.069	NSD	0.067	0.062	0.068	0.071	0.066	0.067	0.065	0.071	0.057	0.060
NAAQS	0.070	2.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070
80% of NAAQS	0.056	1.656	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056
meets EPA criteria for site removal	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

PHC is the combined data from the Ladonia (LAD) site and the Phenix City Gerard Site. (PCG)

WTT combines data from the WET site and the WTT location which are 1.3 miles apart. There are only 3 years of data from these locations so the statistical test cannot be completed.

The data from WRD did not meet the 3 year data completeness requirement for determining a design value for 2015-2017 (90%), however, data completeness was 89% and ADEM has chosen to use this data for this comparison.

NSD = insufficient data to perform calculations.

Additional Sites Analysis

At this time, Appendix D requirements are being met for the number of ozone monitors in the State and all changes to the network have received approval from the US EPA. A review of the population changes across the state shows one area of high growth rate that does not have a monitor. This is the Auburn-Opelika MSA. However, the close proximity of 2 monitors in the Columbus, GA-Phenix City MSA and 2 monitors in the Montgomery MSA suggest that the results of monitoring in the Auburn area would be very similar to the neighboring sites. If resources allow for an additional site, the Auburn area would be a likely candidate.

Particulate Matter Less Than 2.5 Microns ($PM_{2.5}$)

The $PM_{2.5}$ network is characterized by manual monitors located in MSAs that meet the Appendix D requirements, collocated continuous monitors as required in Appendix D, collocated manual monitors for quality assurance purposes as required by Appendix A, and speciation monitors used to characterize the constituents of the particulate matter.

ADEM is currently in the process of assessing new technologies to collect NAAQS compliant continuous $PM_{2.5}$ data to replace the current BAM-1020 monitors which are non-FEM, used only to report to AirNow. Within the next 5 years, ADEM will phase out all remaining non-FEM $PM_{2.5}$ continuous monitors and replace them with either the FEM BAM-1022 or the FEM API T640 depending on the results of the assessment.

This network is fully described in the 2020 ADEM Annual Network Plan. Table 6 presents the ranking matrices for these monitors. The map in Figure 36 shows the locations of the various monitors in the current network and as proposed in the plan. Graphs in Figure 34 and Figure 35 show the monitor trends for the last 10 design values. These graphs show a substantial decline for most monitors.

Updates to the ADEM $PM_{2.5}$ Network since the Last Assessment

Gadsden C College, AQS ID 01-055-0010, and VA, Tuscaloosa, AQS ID 01-125-0004, discontinued continuous non-FEM $PM_{2.5}$ monitoring in 2018. One FRM $PM_{2.5}$ monitor remains in service at each site.

South Girard School (AQS ID 01-113-0003) replaced Phenix City-Downtown particulate matter monitoring site (AQS ID 01-113-0001) and Phenix City-Ladonia ozone monitoring site (AQS ID 01-113-0002). All ambient air monitoring activities in the Phenix City area were consolidated to one location at the South Girard School at 510 6th Place, Phenix City. Particulate matter monitoring began January 18, 2017.

Childersburg (AQS ID 01-121-0002) particulate matter monitoring site was closed December 31, 2017 due to its low design value. This site was not in an MSA and was not required by 40 CFR 58, Appendix D.

Dothan (Civic Center), AQS ID 01-069-0003, as approved in the 2019 network plan, $PM_{2.5}$ monitoring was discontinued at this site on December 31, 2019.

Muscle Shoals, AQS ID 01-033-1002, as approved in the 2019 network plan, all monitoring was scheduled to be discontinued at the end of 2019 and the site shut-down. Ozone monitoring was discontinued at the end of the season on October 31, 2019. $PM_{2.5}$ monitoring was discontinued early with EPA approval on August 4, 2019, due to damage from electrical storms.

Decatur, AQS ID 01-103-0011, a FEM API T640 replaced the existing non-FEM BAM-1020 for continuous $PM_{2.5}$ monitoring, upon installation of the new air monitoring shelter. The shelter manufacturer is located in Ohio. Shelter construction and delivery had been delayed due to Ohio's

COVID-19 shelter in place order. Installation of the shelter and change of equipment was finally completed at the end of June 2020.

Summary of proposed changes for 2020/2021

Below is a list of network changes proposed in the 2020 Plan. The map in Figure 36 shows the current network with the proposed changes.

Phenix City – South Girard School, AQS ID 01-113-0003, $PM_{2.5}$ monitoring is currently performed by two local FRM samplers, primary and collocated, that both collect on a 1 in 3 day schedule and a continuous BAM-1022 monitor. On January 1, 2021, the continuous $PM_{2.5}$ BAM-1022 SPM will be designated as the primary $PM_{2.5}$ SLAMS monitor. To meet collocation requirements for the method, the current collocated local FRM sampler will continue to operate but reduce its collection frequency from 1 in 3 day to a 1 in 6 day schedule. The current primary local FRM sampler will be discontinued on 12/31/2020 and removed from the site.

VA, Tuscaloosa, AQS ID 01-125-0004, $PM_{2.5}$ monitoring is currently performed by one local FRM sampler at this site. On January 1, 2021, to meet collocation requirements of FRM sampling, a second local FRM collocated sampler will begin operations on a 1 in 6 day schedule.

Ward, Sumter Co., AQS ID 01-119-0003, On January 1, 2021, the FEM BAM-1022 will replace the non-FEM BAM-1020 for continuous $PM_{2.5}$ monitoring. As this monitor will be the second continuous FEM monitor in the network, no collocation of a FRM is required at this site.

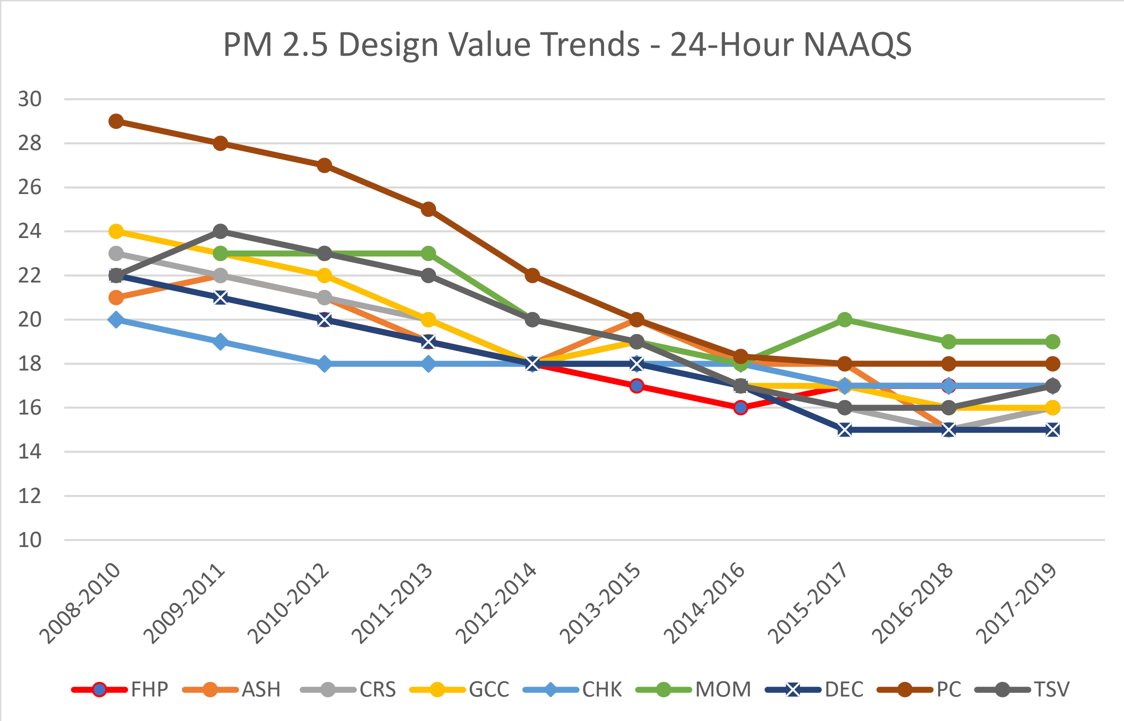


Figure 34 PM$_{2.5}$ Design Value Trends - 24-Hour NAAQS

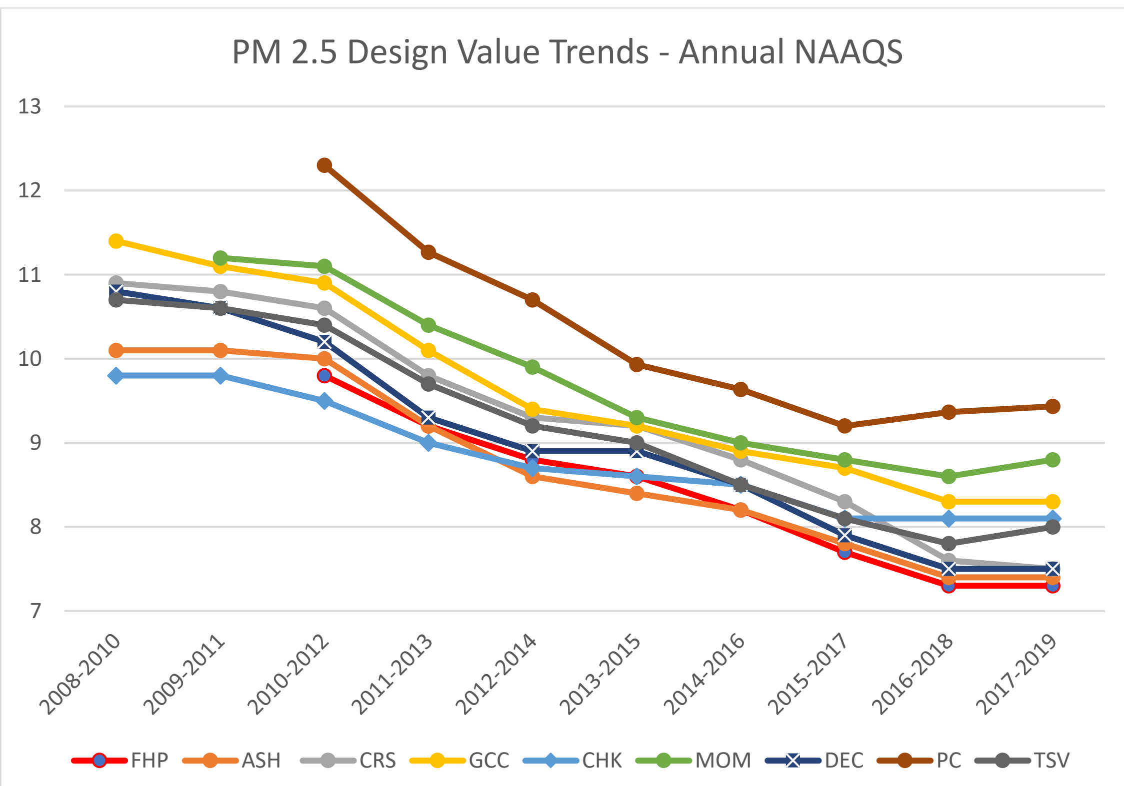


Figure 35 PM$_{2.5}$ Design Value Trends - Annual NAAQS

Table 6 $PM_{2.5}$ Site Rank Matrix

ADEM SITE COMMOM NAME	potential rank value	Fairhope	Ashland	CRS	GAD	Chickasaw	MOMS	Decatur	Phenix City - Girard	Ward	Tuscaloosa Co.
ADEM ABBRV		**FHP**	**ASH**	**CRS**	**GAD**	**CHK**	**MOM**	**DEC**	**PCG**	**WRD**	**TSC**
AQS county code		003	027	049	055	097	101	103	113	119	125
AQS Site ID Number		0010	0001	1003	0010	0003	1002	0011	0003	0003	0010
Appendix D required	15		15	15						15	
Potential to exceed NAAQS	5										
PM2.5 Annual NAAQS Probability	10										
PM2.5 24-hour NAAQS Probability	10			10	10		10	10	10		10
Attainment History	5										
Located in complex terrain	5										
Used for AQI reporting	10	10				10	10		10		
Fills AIRNOW Spatial Needs	5	5	5	5	5	5	5	5	5	5	5
Used in outside studies	5										
Located in unique areas	5										
Background monitor	5		10	10						10	
Transport monitor	5		5								
Community concerns	10	10									
Forecasting	10	10				10	10		10		
Total	105	35	35	40	15	25	35	15	35	30	15

NOTE: NAAQS probability refers to the site closure analysis in Table 8 and Table 9.

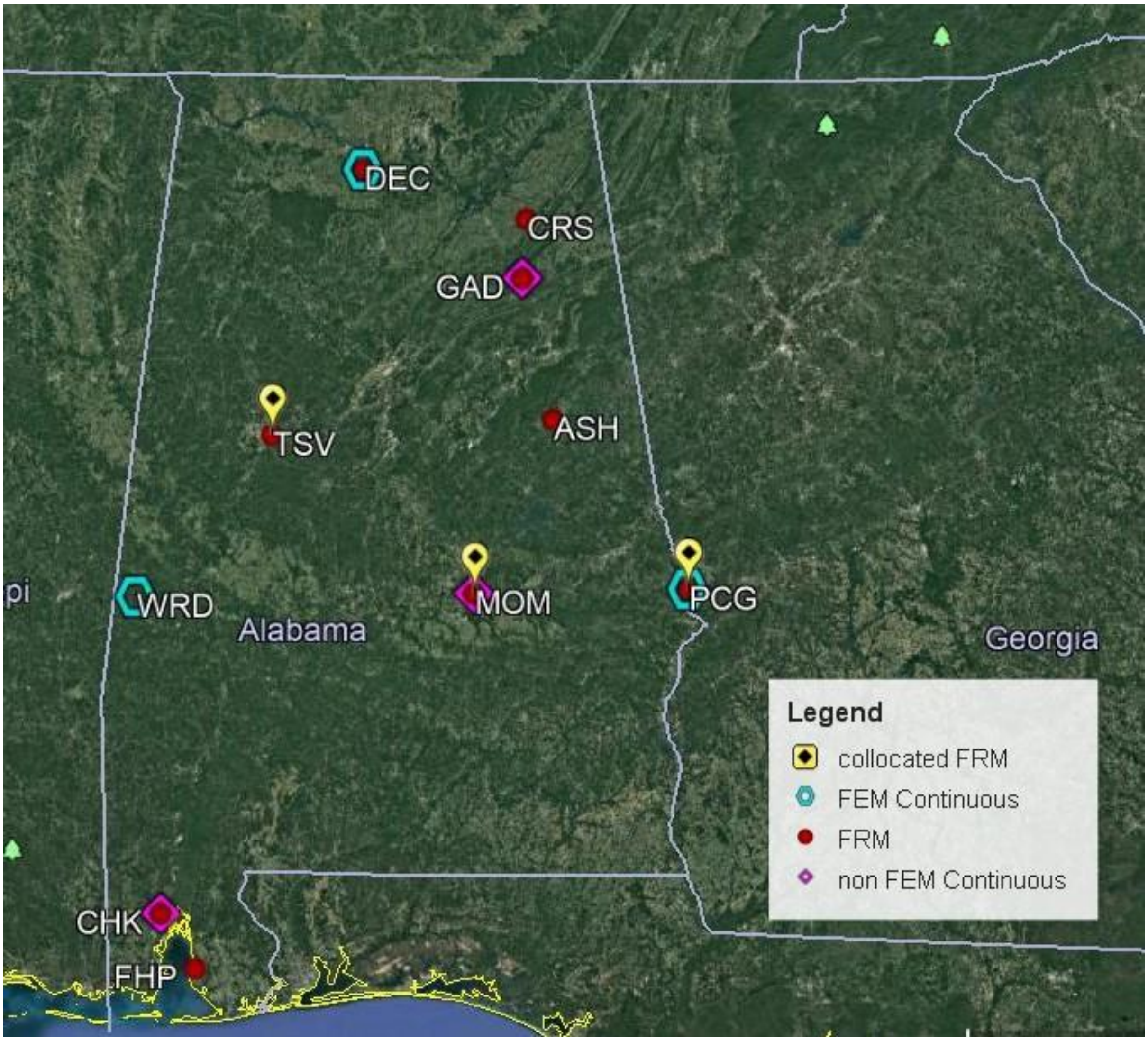


Figure 36 $PM_{2.5}$ Monitor Network with Proposed Changes

Area Served

Voronoi Polygons were generated using the area served statistical tool. A map showing these polygons is shown in Figure 37.

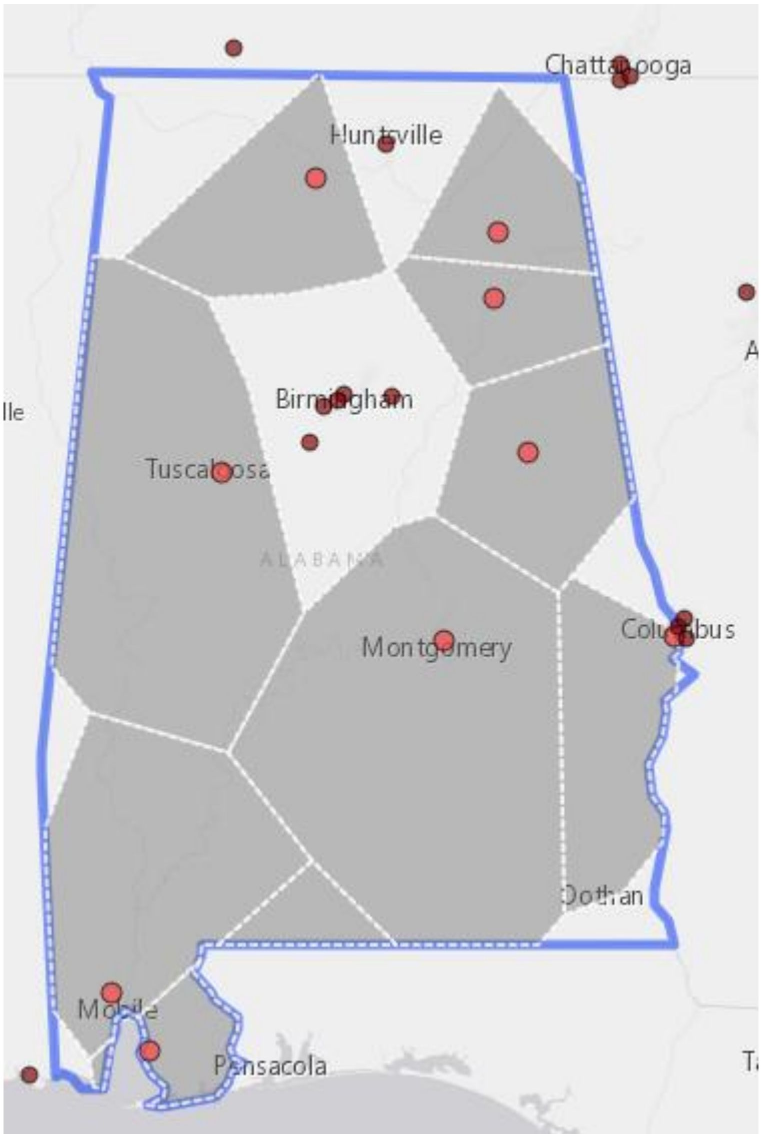


Figure 37 Statewide $PM_{2.5}$ Voronoi Polygons

Using the area served map and Table 7 below, it is indicated that 58 percent of Alabama's population is served by monitors operated by ADEM. Of the remainder, approximately 20 percent of Alabama's population is found in Jefferson and Madison Counties which operate separate monitoring networks.

Table 7 Area Served by ADEM $PM_{2.5}$ Monitors

AQS Site ID	Site Name	County Name	Area (km^2)	$PM_{2.5}$ Exceedance Probability	Total Population
010030010	Fairhope	Baldwin	4788	<10%	180343
010270001	Ashland	Clay	8189	<10%	179384
010491003	Crossville	DeKalb	4929	<10%	187588
010550010	Gadsden C. College	Etowah	4745	<10%	217307
010970003	Chickasaw	Mobile	14661	<10%	489331
011011002	Moms, ADEM	Montgomery	27585	<10%	696791
011030011	Decatur, Alabama	Morgan	8325	<10%	307830
011250004	VA, Tuscaloosa	Tuscaloosa	22120	<10%	344601
011130003	Phenix City - South Girard School	Russell	8483	<10%	247748
Aggregated					
	TOTAL ADEM Served		103,825		2,850,923
	Alabama		135764		4903185
	Percentage of Alabama		76%		58%

Using the area served maps and Table 4 Population and Area Represented in Voronoi Polygons below, it is indicated that 58 percent of Alabama's population is served by monitors operated by ADEM. Of the remainder, approximately 20 percent of Alabama's population is found in Jefferson and Madison Counties which operate separate monitoring networks.

Population

MSA population and design values are used by Appendix D to determine the number of required $PM_{2.5}$ monitors. There are 13 MSAs in Alabama that meet the Appendix D requirements for population. Each MSA is discussed in detail in the 2020 AAQMP Annual Network Plan. Seven of the ten $PM_{2.5}$monitor locations are located in MSAs. The maps in Figure 4 and Figure 5 indicate that these monitors are located in the areas of highest and increasing population. Outside of the MSAs, regional monitors are located in Ashland, Ward and Crossville. There is little redundancy in the ADEM network.

Figure 5 shows that most of the growth in the Mobile area has been in Baldwin County. Mobile and Fairhope are now both metropolitan areas and are considered separately in Appendix D. There is one $PM_{2.5}$ monitor in Mobile County to the north of the central business district and there is a monitor located in Baldwin County in the Fairhope MSA.

Additional growth has occurred in Limestone County. This is part of the Huntsville MSA. The air quality in this area is adequately represented by the $PM_{2.5}$ monitors in the adjacent counties of Madison and Morgan.

Lee County is also a growth area. A monitor is not required in this MSA and there are monitors in the nearby MSAs of Montgomery and Columbus, GA/Phenix City, AL.

Emissions

Highest emissions in areas of higher populations.

Due to Appendix D requirements most of ADEM's monitors are located in MSAs with higher population and this corresponds to greater emission sources. The location of these sources can be used to determine the suitability for determining the highest concentration monitor locations.

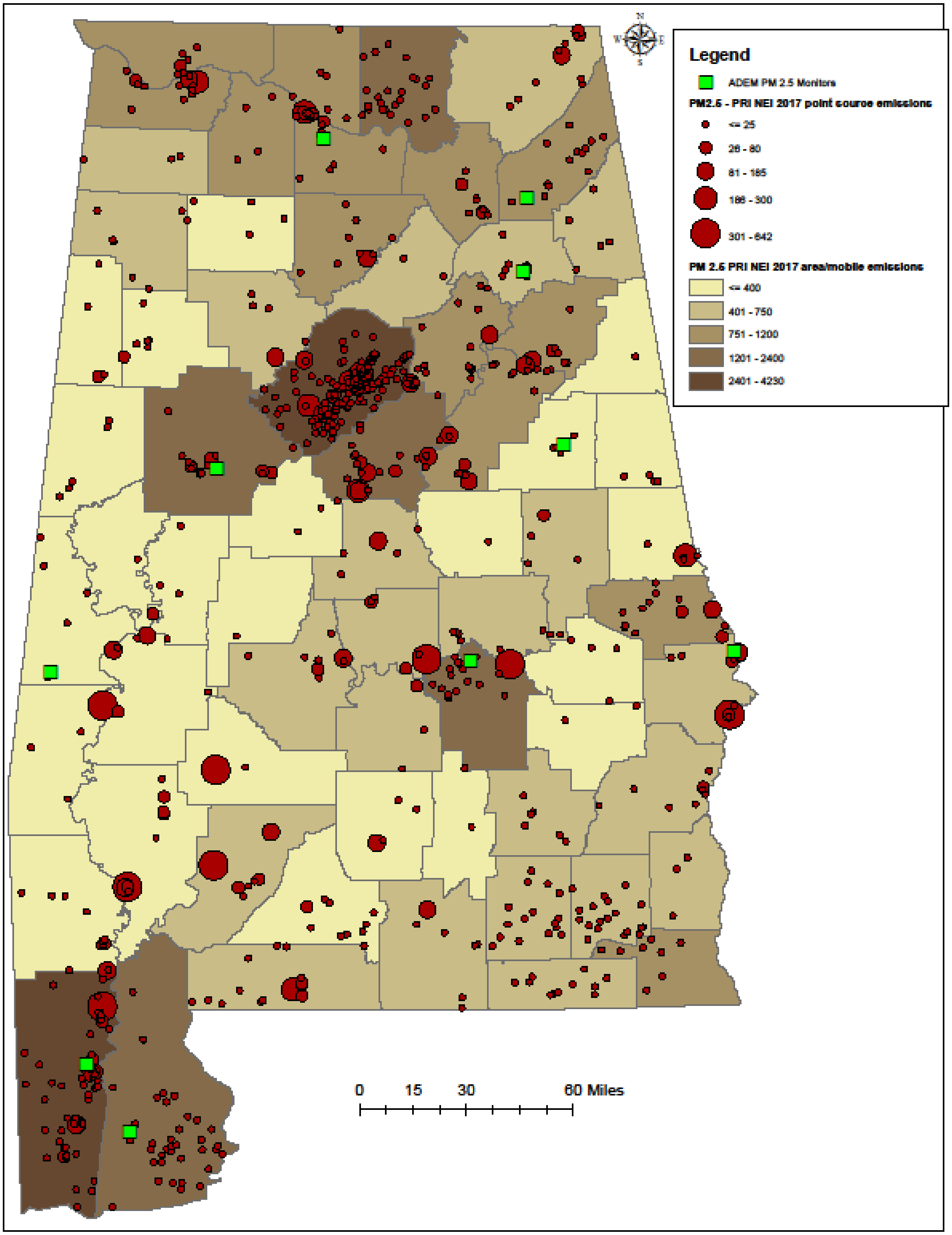


Figure 38 Statewide $PM_{2.5}$ Point Source and Area/Mobile Emissions

Site Correlation and Removal

Site Correlation

As ambient concentration of particulate matter has trended downward over time, sites across the state have measured similar levels. This may be indicated in the matrix below. Some sites which are separated by a substantial distance appear to have good correlation. Two sites that are located in close proximity (36km) are FHP and CHK, which appear to highly correlated and possibly redundant; however, these sites are in separate MSAs and are indicative of different sources. Another pair of monitors that are close together are CRS and GAD. The GAD monitor is located to represent the Gadsden MSA and the CRS monitor is located at the EPA CASTNET background site near Crossville. Each of these monitors represents a unique objective in the network.

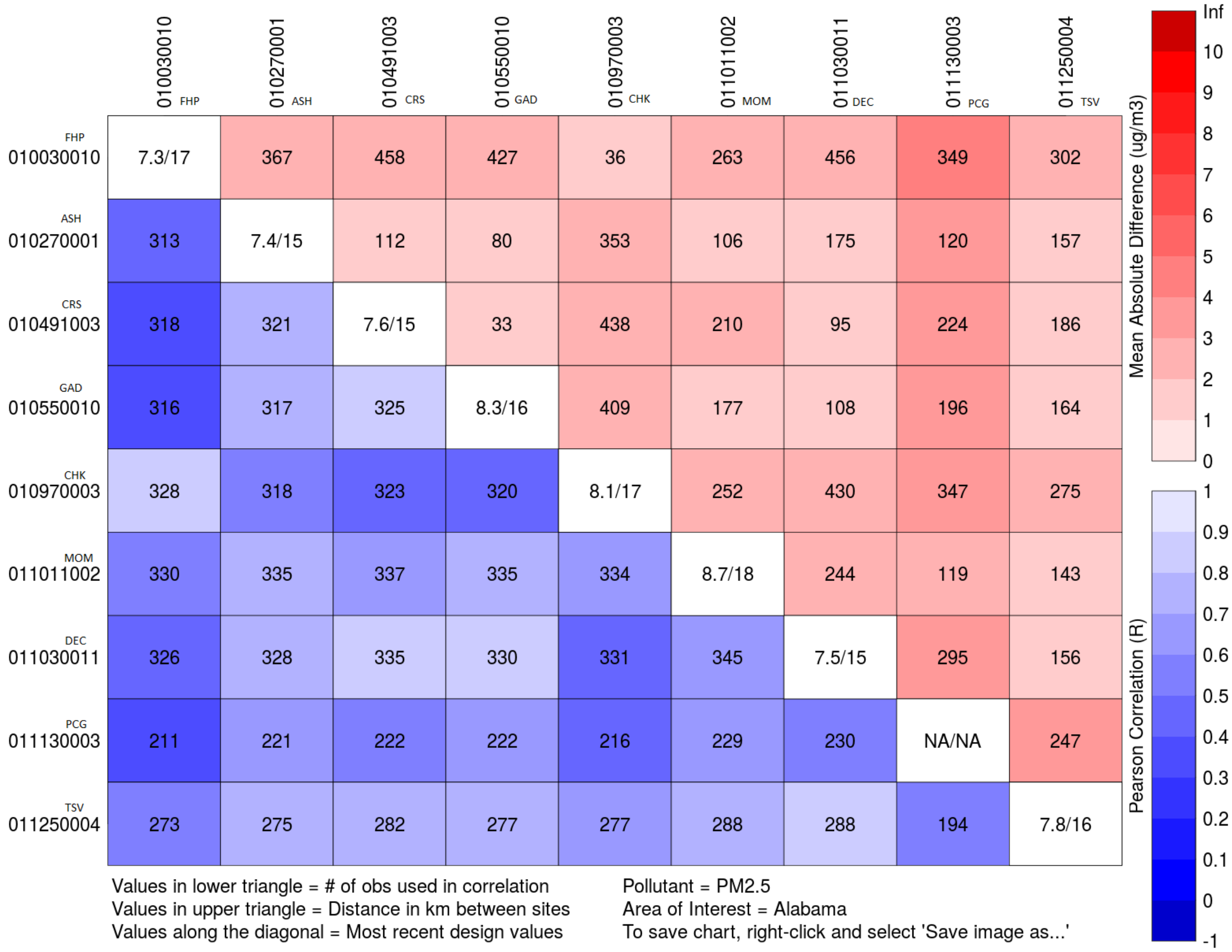


Figure 39 Statewide $PM_{2.5}$ Site Correlation Matrix

Site Removal Analysis

Table 8 $PM_{2.5}$ Site Closure Analysis 24-hour NAAQS

	FHP	ASH	CRS	GCC	CHK	MOM	DEC	PC*	TSV
2008-2010		21	23	24	20		22	29	22
2009-2011		22	22	23	19	23	21	28	24
2010-2012	20	21	21	22	18	23	20	27	23
2011-2013	19	19	20	20	18	23	19	25	22
2012-2014	18	18	18	18	18	20	18	22	20
2013-2015	17	20	19	19	18	19	18	20	19
2014-2016	16	18	17	17	18	18	17	18	17
2015-2017	17	18	16	17	17	20	15	18	16
2016-2018	17	15	15	16	17	19	15	18	16
2017-2019	17	16	16	16	17	19	15	18	17
Average Design Value	**18**	**19**	**19**	**19**	**18**	**20**	**18**	**22**	**20**
n	**8**	**10**	**10**	**10**	**10**	**9**	**10**	**10**	**10**
student's t	**1.89**	**1.83**	**1.83**	**1.83**	**1.83**	**1.86**	**1.83**	**1.83**	**1.83**
stdev.S	1.302	2.251	2.751	2.936	0.943	2.007	2.539	4.513	3.026
Probability	18.5	20.1	20.3	20.9	18.5	21.7	19.5	24.9	21.4
NAAQS	35	35	35	35	35	35	35	35	35
80% of NAAQS	28	28	28	28	28	28	28	28	28
meets EPA criteria for site removal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

* PC includes data from downtown Phenix City Sites and the current PCG site to present long term trends in the area.

Table 9 $PM_{2.5}$ Site Closure Analysis Annual NAAQS

	FHP	ASH	CRS	GCC	CHK	MOM	DEC	PC	TSV
2008-2010		10.1	10.9	11.4	9.8		10.8		10.7
2009-2011		10.1	10.8	11.1	9.8	11.2	10.6		10.6
2010-2012	9.8	10.0	10.6	10.9	9.5	11.1	10.2	12.3	10.4
2011-2013	9.2	9.2	9.8	10.1	9.0	10.4	9.3	11.3	9.7
2012-2014	8.8	8.6	9.3	9.4	8.7	9.9	8.9	10.7	9.2
2013-2015	8.6	8.4	9.2	9.2	8.6	9.3	8.9	9.9	9.0
2014-2016	8.2	8.2	8.8	8.9	8.5	9.0	8.5	9.6	8.5
2015-2017	7.7	7.8	8.3	8.7	8.1	8.8	7.9	9.2	8.1
2016-2018	7.3	7.4	7.6	8.3	8.1	8.6	7.5	9.4	7.8
2017-2019	7.3	7.4	7.5	8.3	8.1	8.8	7.5	9.4	8.0
Average Design Value	**8**	**9**	**9**	**10**	**9**	**10**	**9**	**10**	**9**
n	**8**	**10**	**10**	**10**	**10**	**9**	**10**	**8**	**10**
student's t	**1.89**	**1.83**	**1.83**	**1.83**	**1.83**	**1.86**	**1.83**	**1.89**	**1.83**
stdev.S	0.905	1.075	1.253	1.169	0.678	1.013	1.216	1.100	1.108
Probability	9.0	9.3	10.0	10.3	9.2	10.3	9.7	11.0	9.8
NAAQS	12	12	12	12	12	12	12	12	12
80% of NAAQS	10	10	10	10	10	10	10	10	10
meets EPA criteria for site removal	Yes	Yes	NO	NO	Yes	NO	NO	NO	NO

Summary of $PM_{2.5}$ Findings and Recommendations for Change to the $PM_{2.5}$ Network

Emission Densities, Population, Meteorology and Ambient Concentrations have been taken into account during the siting of the $PM_{2.5}$ monitors in Alabama's network. While the 2020 Ambient Air Quality Monitoring Plan shows several of the current monitors are no longer required by Appendix D due to a reduction in ambient concentrations in recent years, the site matrix analysis shows that most of the monitors are still important in the network. The current network provides broad coverage across Alabama and also provides more intensive monitoring in areas of higher population and emissions.

Possible changes to the network

For the reasons mentioned above, changes to the $PM_{2.5}$ network are not foreseen at this time.

Particulate Matter Less Than 10 Microns (PM 10)

All of the monitoring requirements of Appendix D are met for the MSAs in Alabama. These requirements are based on the design values and the population of the MSA. A map showing the current PM_{10} site is found in Figure 41.

The Montgomery MSA has low concentrations and is required by Appendix D to have from 0 to 1 monitor. Montgomery has 1 manual method site with a collocated quality assurance monitor.

Updates to the PM_{10} Network since the Last Assessment

MOMS, ADEM, AQS ID 01-101-1002, replaced hi-vol samplers with low-vol samplers for PM_{10} monitoring in 2018.

Possible changes to the network

There are no planned changes to the PM_{10} network at this time.

NAAQS

Pollutant		Averaging Time	Level	Form
PM10	primary and secondary	24 hours	150 µg/m3	Not to be exceeded more than once per year on average over 3 years

PM_{10} Data Trend

As the chart below shows, although there is substantial variability in the maximum daily values, the data is consistently less than 50 percent of the NAAQS.

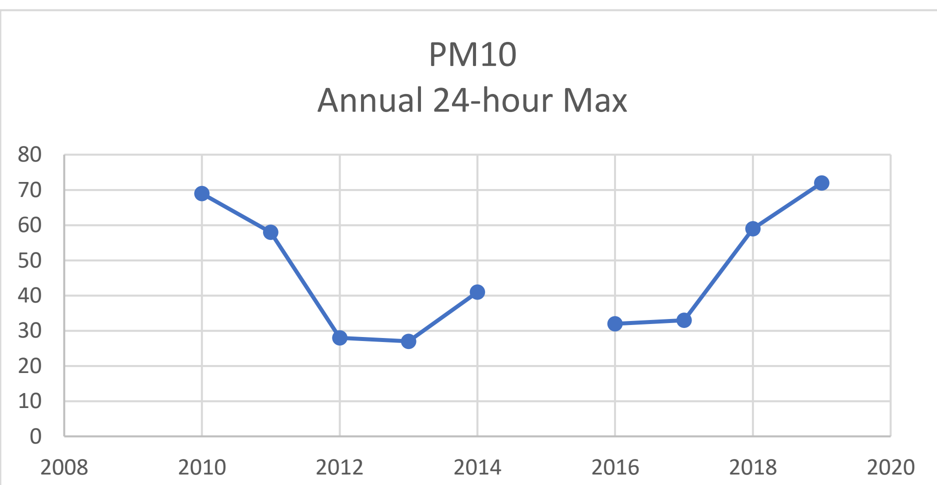


Figure 40 PM_{10} Data Trend

Note: Data from 2014 through 2016 was incomplete due to quality assurance issues.

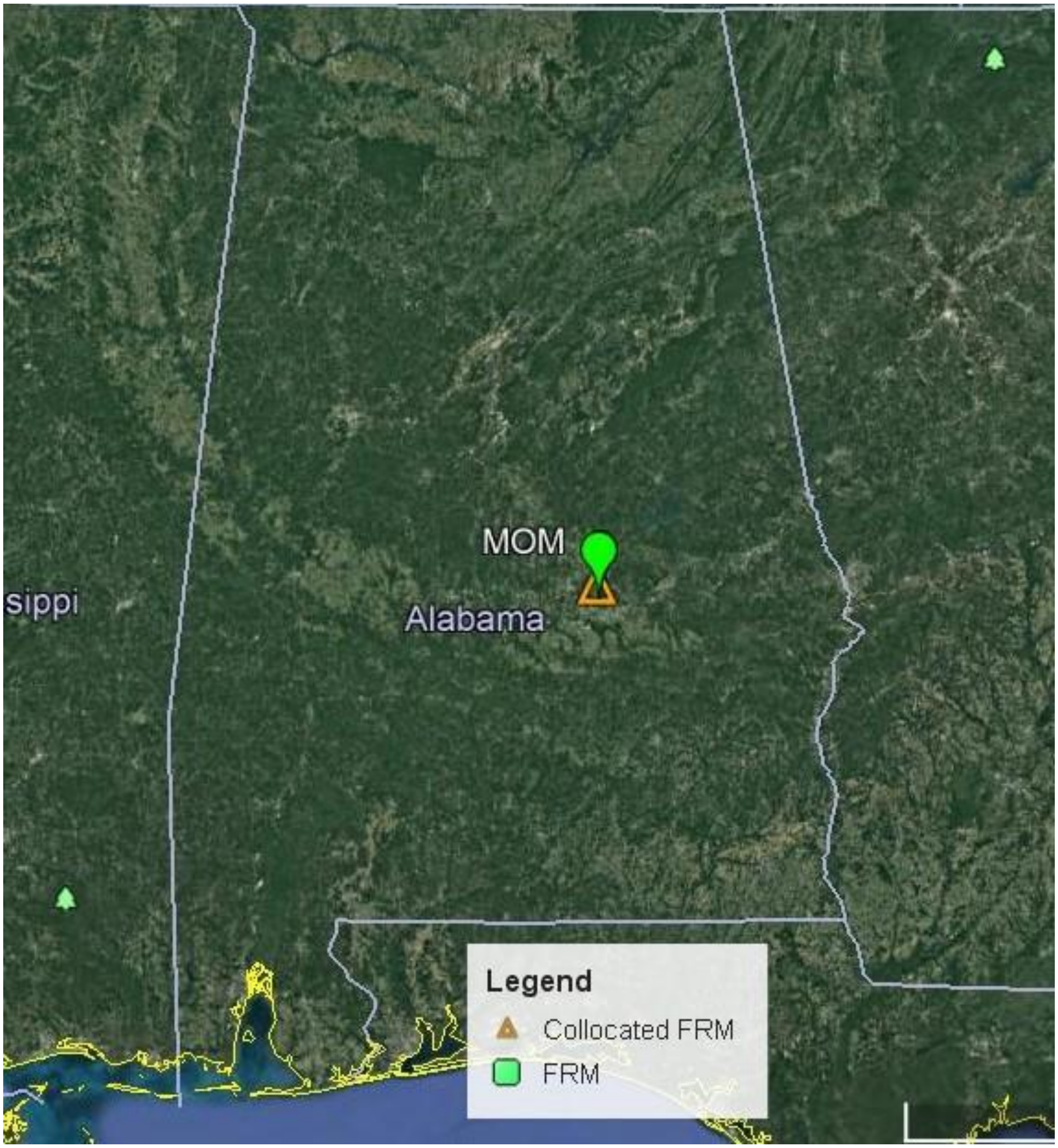


Figure 41 ADEM PM_{10} Network

Sulfur Dioxide (SO_2)

On June 2, 2010, EPA strengthened the primary National Ambient Air Quality Standard (NAAQS) for sulfur dioxide (SO_2). EPA revised the primary SO_2 standard and established a new 1-hour standard at a level of 75 parts per billion (ppb).

Current NAAQS				
Sulfur Dioxide (SO2)	primary	1 hour	75 ppb (1)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

(1) The previous SO2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2)any area for which an implementation plan providing for attainment of the current (2010) standard has not been submitted and approved and which is designated nonattainment under the previous SO2 standards or is not meeting the requirements of a SIP call under the previous SO2 standards (40 CFR 50.4(3)). A SIP call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the required NAAQS.

SO_2 Trends

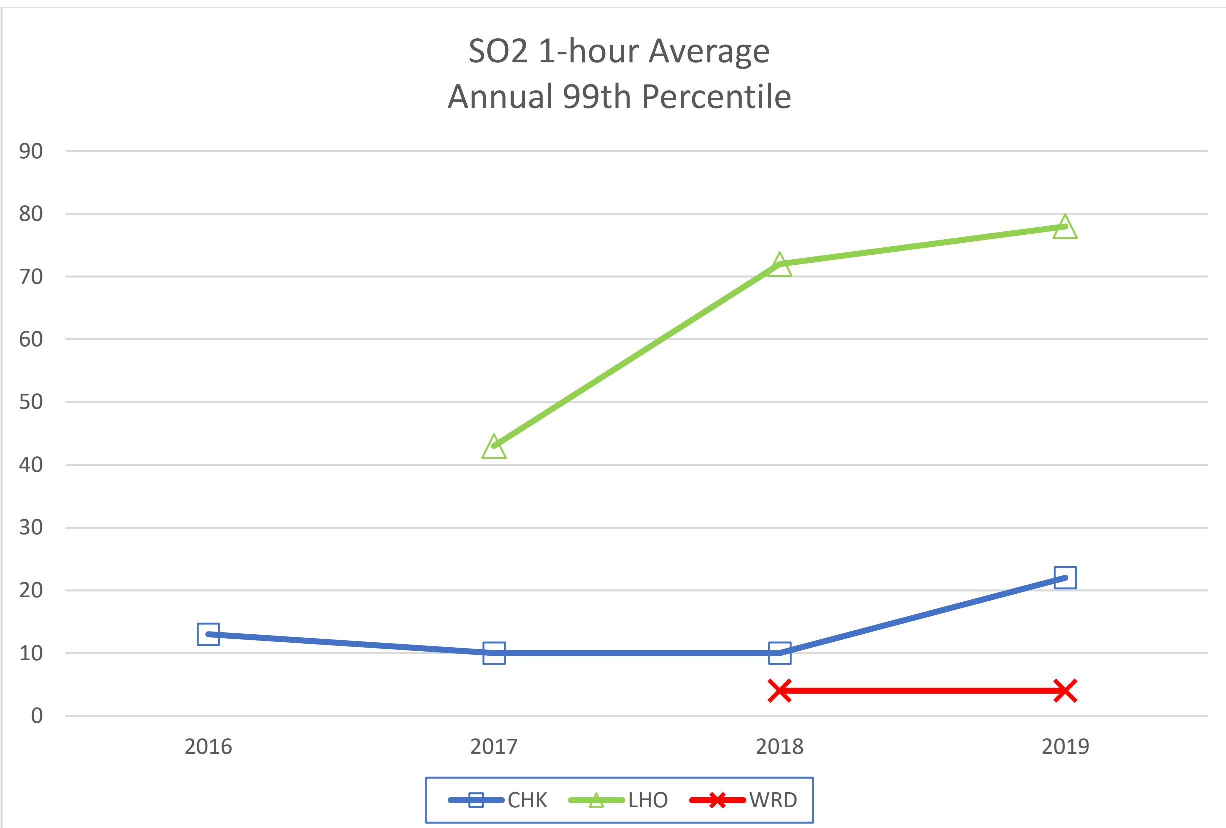


Figure 42 SO_2 Data Trends

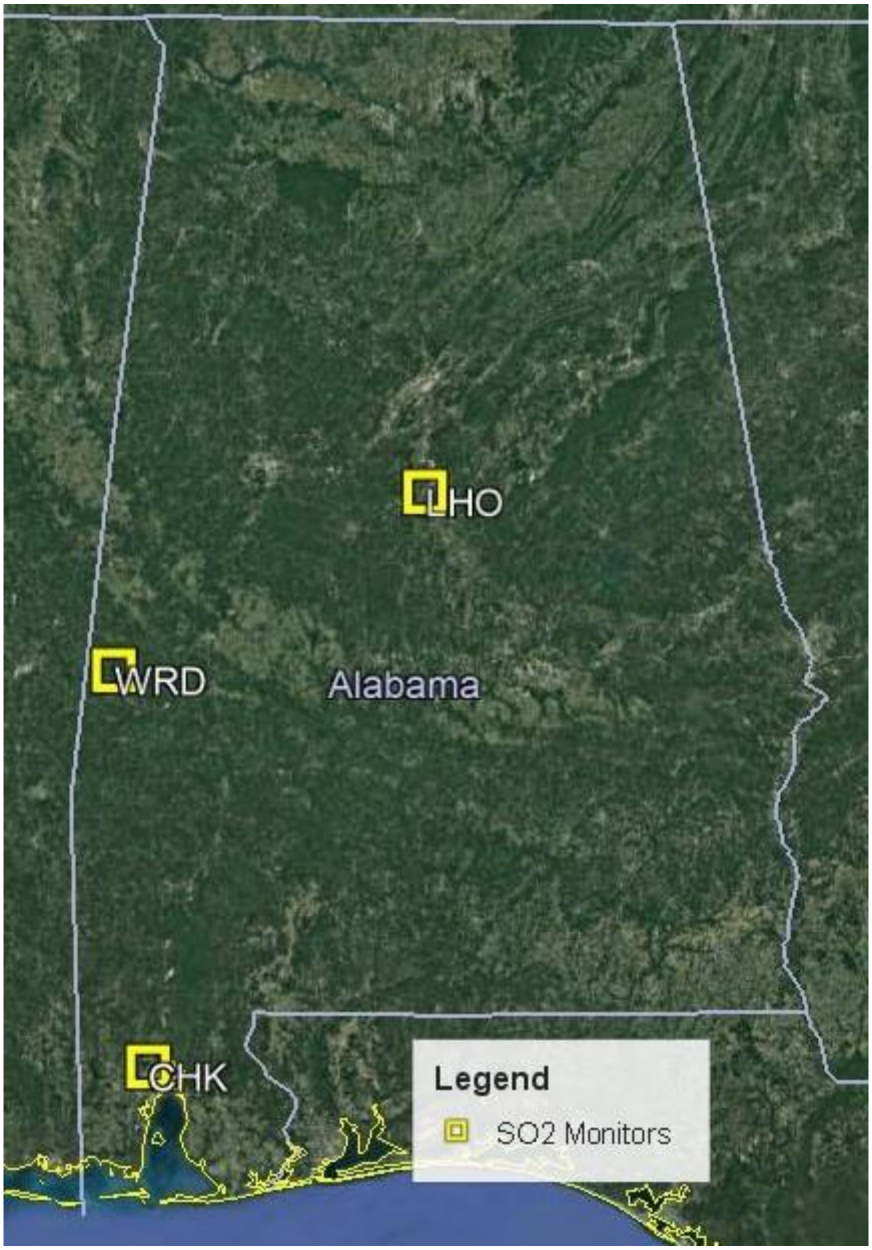


Figure 43 Map of Current SO_2 Monitoring Sites

EPA has set specific minimum requirements that inform states on where they are required to place SO_2 monitors. The final monitoring regulations require monitors to be placed in Core Based Statistical Areas (CBSAs) based on a population weighted emissions index, PWEI, for the area. The final rule requires:

- 3 monitors in CBSAs with index values of 1,000,000 or more;
- 2 monitors in CBSAs with index values less than 1,000,000 but greater than 100,000; and
- 1 monitor in CBSAs with index values greater than 5,000.

All newly sited SO_2 monitors were operational by January 1, 2013 and these requirements are reviewed annually and reported in the ADEM Network Plan. According to Table 7 in the 2020 Plan, only the Birmingham-Hoover MSA requires SO_2 monitoring based on the current emissions. ADEM has operated an SO_2 monitor, **Chickasaw, AQS ID 01-097-0003**, for the Mobile MSA based on previous PWEI calculations. This area no longer meets the threshold for population/emissions.

A monitor is located at **Ward, Sumter Co., AQS ID 01-119-0003**, not located in an MSA, to collect background data for modelling purposes.

For more information regarding SO_2 monitoring in the Birmingham-Hoover MSA, refer to the JCDH ambient air monitoring network plan.

SO_2 DRR – *SO_2 Data Requirements Rule*: DRR became effective September 21, 2015. Per 40 CFR Part 51, states are required to report all sources that generate >2,000 TPY SO_2, not dependent upon population density. Each source in this category must characterize air quality through air quality modeling or ambient air monitoring. Each source that chooses monitoring must operate their site equivalent with the SLAMS requirements of 40 CFR Part 58. Source-oriented monitoring for SO_2 began on January 1, 2017, and continues to operate in its second 3-yr cycle. Alabama has one DRR SO_2 monitoring site, Lhoist, Montevallo Plant, AQS ID 01-117-9001, operated by a Lhoist contractor within the ADEM PQAO.

The current network and point source SO_2 emissions are represented in the map in Figure 44.

Updates to the SO_2 Network since the last Assessment

Lhoist (AQS ID 01-117-9001) SO_2 DRR monitoring site was added to Alabama's Air Network. Monitoring began January 1, 2017.

ADEM began monitoring SO_2 at Ward, Sumter County (AQS ID 01-119-0003) as a background site in 2018. The monitor is designated as a Special Purpose Monitor (SPM).

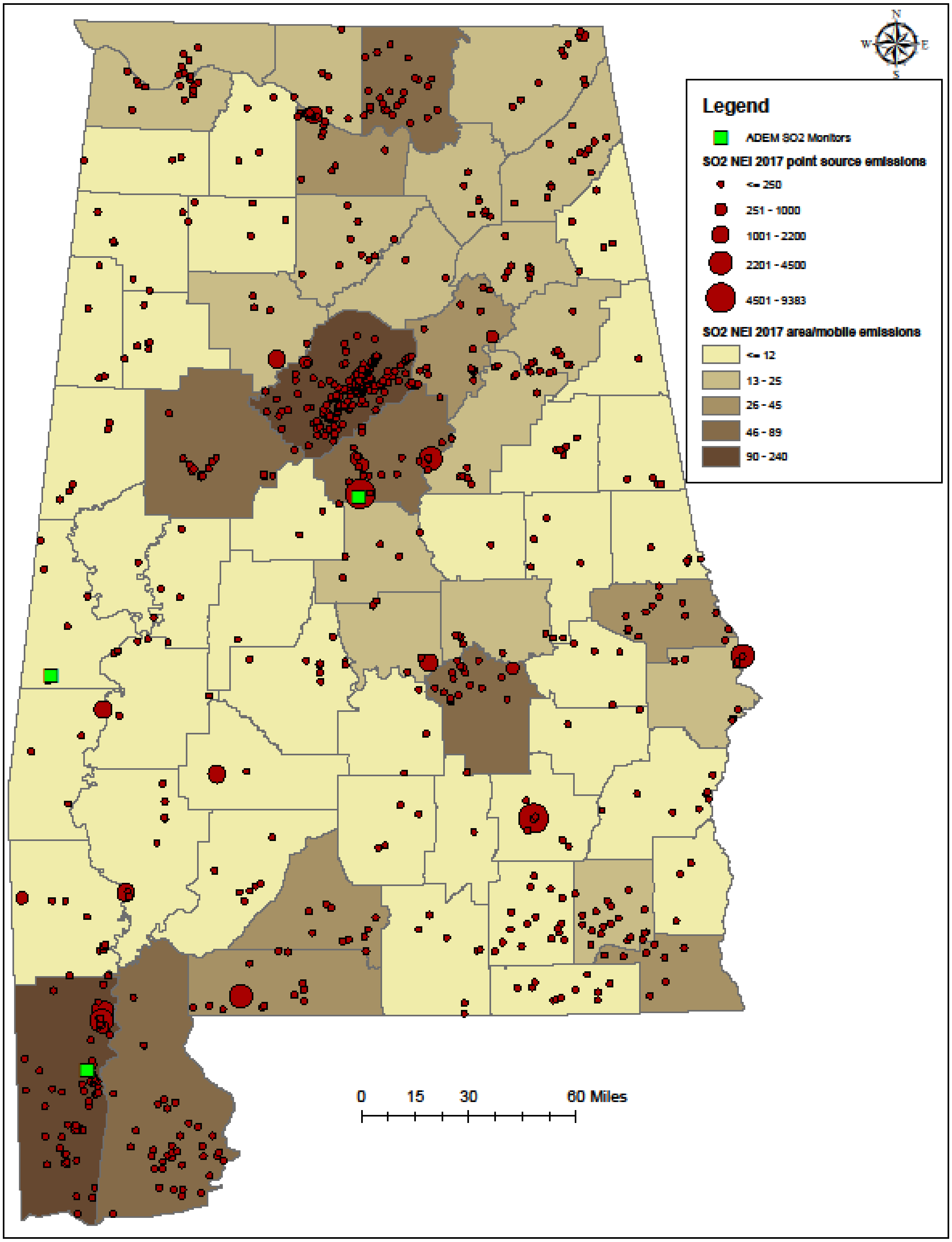


Figure 44 Sulfur Dioxide Emission with MSA Populations

Suitability of Location

The suitability for siting DRR monitors is determined by modelling of emissions from a specific source, such as Lhoist, and nearby sources that meet the threshold in the rule.

ADEM's background monitor in Ward was sited in a rural area which is not expected to be influenced by specific sources. It is intended to represent a large area and to identify SO_2 transport trends and background concentrations.

A broad range of monitoring objectives can be used to meet the PWEI requirements. The Chickasaw monitor was sited near SO_2 sources in the Mobile MSA to characterize the highest concentration on a neighborhood scale.

Plans for the Network.

If the emissions and monitoring data remain below the threshold in the Mobile MSA, ADEM may consider discontinuing SO_2 monitoring at Chickasaw. Monitoring at the Lhoist DRR site will continue until requirements of the rule are met.

Lead (Pb)

In 2008, the US EPA revised the National Ambient Air Quality Standard for lead. The lead standard was lowered from 1.5 µg/m3 for a quarterly average to 0.15 µg/m3 based on the highest rolling 3 month average over a 3 year period. EPA set minimum monitoring requirements for source and population oriented monitoring.

On December 27, 2010, EPA finalized revisions to the Lead Monitoring Rule pertaining to where state and local monitoring agencies would be required to conduct lead monitoring. [Revisions to the Lead Ambient Air Monitoring Requirements, FR/ Vol 75, No. 247 (PDF) (13pp, 199k)]

- EPA set the emission threshold to 0.50 tons per year (TPY) for industrial sources of lead and required monitoring agencies to install and begin operation of source-oriented monitors near lead sources emitting 0.50 TPY or more but less than 1.0 TPY by December 27, 2011 (monitoring for 1.0 TPY and greater lead sources was required to begin in January 1, 2010, by the 2008 Lead Standard).
- EPA maintained the 1.0 TPY lead emission threshold for airports. However, EPA required monitoring agencies to conduct ambient air lead monitoring near 15 additional airports emitting 0.50 TPY or more but less than 1.0 TPY for a period of 12 consecutive months commencing no later than December 27, 2011.
- EPA required monitoring agencies to install and begin operation of non-source oriented monitors at NCore sites in Core-Based Statistical Areas (CBSAs) with a population of 500,000 people or more by December 27, 2011, and revoked the existing requirement for non-source oriented monitoring (40 CFR part 58, Appendix D, paragraph 4.5(b)).
    - In March, 2016, EPA removed the requirement for Pb monitoring at NCore sites that were not located near a Pb emissions source.

On September 16, 2016, based on its review of the air quality criteria for lead (Pb), the Environmental Protection Agency issued a decision to retain the existing 2008 standards without revision.

Current Network and Trends

Figure 45 ADEM Lead Network

Lead Data Trends

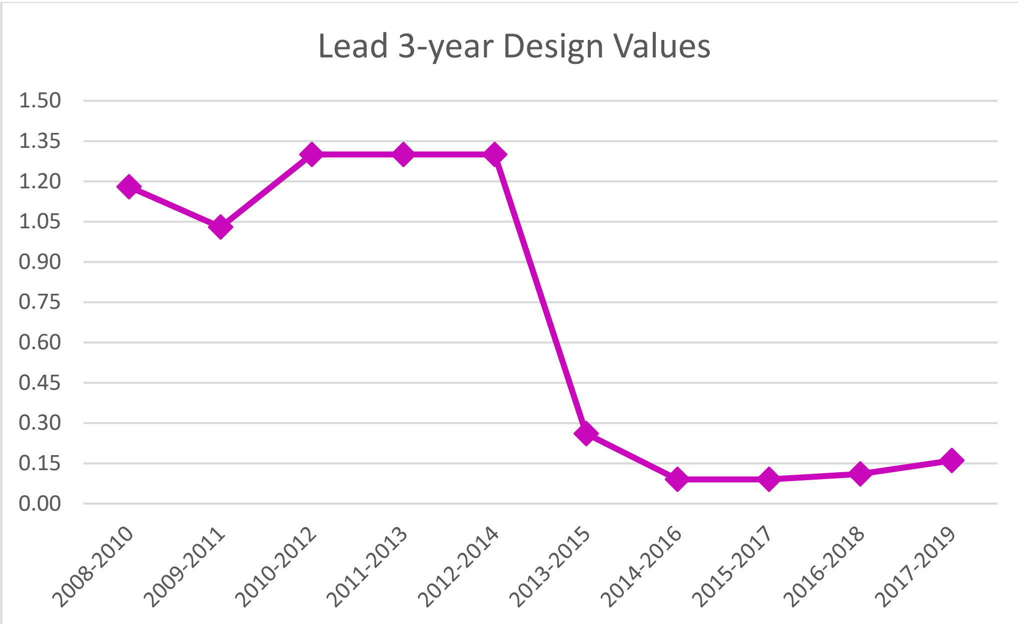


Figure 46 Lead 3-Year Design Value Trend

AQS Site ID	011090003
Site	TRY
Years	**Design Values**
2008-2010	1.18
2009-2011	1.03
2010-2012	1.30
2011-2013	1.30
2012-2014	1.30
2013-2015	0.26
2014-2016	0.09
2015-2017	0.09
2016-2018	0.11
2017-2019	0.16

Figure 47 Troy Design Value Trend

Source Oriented Monitors

After evaluating the most recent emissions information, the only source that exceeds the 0.5 ton per year threshold for Lead (Pb) is the Sanders Lead Company in Troy, Alabama. On November 12, 2012, ADEM submitted a revision to the State Implementation Plan for the purpose of providing for the attainment of the 2008 Lead (Pb) NAAQS for the Troy Lead Nonattainment Area. EPA proposed to approve the revision to the SIP on September 6, 2013 and the final rule was effective on February 27, 2014. ADEM has an existing monitor (AQS ID 01-109-0003) near that source.

The Troy nonattainment area was designated to attainment on June 20, 2018. This monitor appears to be properly sited and ADEM will continue to operate the monitor in this location.

No additional monitoring are required for lead sources in Alabama.

Nitrogen Dioxide (NO_2)

On January 22, 2010, the US EPA finalized the monitoring rules for Nitrogen Dioxide. The rules include requirements for the placement of new NO_2 monitors in urban areas. These include:

Near Road Monitoring

At least one micro-scale monitor must be located near a major road in each CBSA with a population greater than 1 million people and a second monitor is required near another major road in areas with either a CBSA population ≥2.5 million people, or one or more road segments with an annual average daily traffic (AADT) count ≥250,000 vehicles. Alabama's largest CBSA, Birmingham-Hoover, has a population greater than 1 million but less than 2.5 million and no road segments with AADT greater than 250,000 vehicles. Therefore, one near-road monitoring site would be required in this area. This site is located in Jefferson County. Refer to the JCDH Ambient Air Network Plan for details.

Community Wide Monitoring

The rules also require an NO2 monitor to be placed in any urban area with a population greater than or equal to 1 million people to assess community-wide concentrations. Birmingham-Hoover is the only MSA in Alabama with a population greater than 1 million. Refer to the JCDH Ambient Air Network Plan for details.

Monitoring to Protect Susceptible and Vulnerable Populations

Working with the states, EPA Regional Administrators identified at least 40 additional NO_2 monitors to help protect communities that are susceptible and vulnerable to NO_2-related health effects. EPA has not identified a need for additional monitors in Alabama.

At this time there are no NO_2 monitors in the ADEM network.

The Planning Section of the ADEM Air Division has identified a need for a monitor to characterize background concentrations of nitrogen oxides. If resources are available, ADEM will consider adding an additional monitor to the Ward site for this purpose.

Carbon Monoxide (CO)

On August 12, 2011, EPA issued a decision to retain the existing National Ambient Air Quality Standards (NAAQS) for carbon monoxide (CO). After careful review of the available health science, EPA concludes that the current standards provide the required level of public health protection, including protection for people with heart disease, who are especially susceptible to health problems associated with exposures to CO in ambient air. The greatest sources of CO to outdoor air are cars, trucks and other vehicles or machinery that burn fossil fuels.

The existing primary standards are 9 parts per million (ppm) measured over 8 hours, and 35 ppm measured over 1 hour.

The new requirements resulted in approximately 52 CO monitors operating near roads within 52 urban areas, including the Birmingham-Hoover MSA, as part of the overall CO monitoring network.

There are no secondary (welfare-based) NAAQS for CO due to a lack of evidence of direct effects on public welfare at ambient concentrations. EPA has concluded that the current evidence does not provide support for establishing secondary CO standards.

Appendix D requires one CO monitor to be located with required Near-Road NO2 monitors in CBSAs greater than 1 million population. The Birmingham-Hoover MSA is required to have a Near-Road site in this category. Refer to the JCDH Ambient Air Network Plan for details.

The ADEM air monitoring network does not include any carbon monoxide monitors. There are no plans to modify the network at this time.

Appendix - Analytical Tools Explanation

Site Correlation Tool

The Correlation Matrix tool calculates and displays the correlation, relative difference, and distance between pairs of sites within a user selected set of air monitoring sites. Within the NetAssess App the Correlation Matrix Tool generates a graphical display and a downloadable CSV file which summarize the results for each selected site pair. The purpose of this tool is to provide a means of determining possible redundant sites that could be removed. Possible redundant sites would exhibit fairly high correlations consistently across all of their pairings and would have low average relative difference despite the distance. Usually, it is expected that correlation between sites will decrease as distance increases. However, for a regional air pollutant such as ozone, sites in the same air shed can have very similar concentrations and be highly correlated. More unique sites would exhibit the opposite characteristics. They would not be very well correlated with other sites and their relative difference would be higher than other site to site pairs. The Correlation Matrix Tool included in the NetAssess App is a modification of the CorMat tool included in the original Network Assessment Tools developed by Mike Rizzo for the 2010 5-year Network Assessment.

Graphical Display

The Correlation Matrix tool generates a graphical display that summarizes the correlation, relative difference and distance between pairs of monitoring sites. Within the graphical display, the shape of the ellipses represents the Pearson correlation between sites. Circles represent zero correlation and straight diagonal lines represent a perfect correlation.

The correlation between two sites quantitatively describes the degree of relatedness between the measurements made at two sites. That relatedness could be caused by various influences including a common source affecting both sites to pollutant transport caused meteorology. The correlation, however, may indicate whether a pair of sites is related, but it does not indicate if one site consistently measures pollutant concentrations at levels substantially higher or lower than the other. For this purpose, the color of the ellipses represents the average relative difference between sites where the daily relative difference is defined as:

$$\frac{abs(s1 - s2)}{avg(s1, s2)}$$

where s1 and s2 represent the ozone concentrations at sites one and two in the pairing, abs is the absolute difference between the two sites and avg is the average of the two site concentrations. The average relative difference between the two sites is an indicator of the overall measurement similarity between the two sites. Site pairs with a lower average relative difference are more similar to each other than pairs with a larger difference. Both the correlation and the relative difference between sites are influenced by the distance by which site pairs are separated. Usually, sites with a larger distance between them will generally be more poorly correlated and have large differences in the corresponding pollutant concentrations. The distance between site pairs in the correlation matrix graphic is displayed in kilometers in the middles of each ellipse. The accompanying CSV file provides information about the individual site pairings including the summary statistics for the relative difference calculations, the R2 correlation value and the distance between the sites.

The purpose of this particular analysis/tool is to provide a means of determining possible redundant sites that could be removed. Possible redundant sites would exhibit fairly high correlations of 0.6 consistently across all of their pairings and would have low average relative difference despite the distance. Usually, it is expected that correlation between sites will decrease as distance increases. However, for a regional air pollutant such as ozone, sites in the same air shed can have very similar concentrations and be highly correlated. More unique sites would exhibit the opposite characteristics. They would not be very well correlated with other sites and their relative difference would be higher than other site to site pairs.

Site Closure Analysis

In addition to the requirement for state or local monitoring agencies to conduct a network assessment every 5 years, the October 17, 2006 amendments to the national monitoring regulations added a requirement that a state or local agency seek the Regional Administrator's approval prior to shutting down a State or Local Air Monitoring Site (SLAMS) Federal Reference Method (FRM), Federal Equivalent Method (FEM), or Approved Regional Method (ARM) monitor. While the Regional Administrator may approve any monitor shutdown on a case-by-case basis, the monitoring regulations specify several situations where the state or local agency can be confident the request for monitor shutdown will be approved [40 CFR 58.14(c)]. The following paragraphs describe these situations.

In this Network Assessment, ADEM performed the calculations in item 2 below for ozone and $PM_{2.5}$ in order to characterize the state of collected data at each site and to aid in the ranking of the monitors. Guidance for this analysis if from the following:

> AMBIENT AIR MONITORING NETWORK ASSESSMENT GUIDANCE-Analytical Techniques for Technical Assessments of Ambient Air Monitoring Networks, EPA-454/D-07-001, February 2007

A monitor can be removed (after Regional Administrator approval) if it is currently in attainment with the applicable NAAQS standard and if the following four tests can be met:

1. The $PM_{2.5}$, ozone, carbon monoxide (CO), PM_{10}, sulfate dioxide (SO_2), lead, or nitrogen dioxide (NO2) monitor showed attainment during the previous five years.

2. The probability is less than 10% that the monitor will exceed 80% of the applicable NAAQS during the next three years based on the concentrations, trends, and variability observed in the past.

3. The monitor is not specifically required by an attainment plan or maintenance plan.

4. The monitor is not the last monitor in a nonattainment area or maintenance area that contains a contingency measure triggered by an air quality concentration in the latest attainment or maintenance plan adopted by the state and approved by EPA.

Tests 1, 3 and 4 are straightforward and do not require additional guidance. However, Test 2 is more complicated. While other methods may be approved by the Regional Administrator, one approach to conservatively demonstrate the second test is to use the equation below.

$$\overline{X} + \frac{t * s}{\sqrt{n}} < 0.8 * NAAQS$$

X is the average design value for the last 5 years (or more),
t is the student's t value for n-1 degrees of freedom at the 90% confidence level,
s is the standard deviation of the design values,
n is the number of records (i.e., number of design values), and
NAAQS is the standard of interest.

AMBIENT AIR MONITORING NETWORK ASSESSMENT GUIDANCE-Analytical Techniques for Technical Assessments of Ambient Air Monitoring Networks, EPA-454/D-07-001, February 2007

Area Served

NetAssess2020 app was developed by EPA's Office of Air Quality Planning and Standards. (OAQPS). It is an update of the NetAssess app developed by LADCO for the 2015 5-year Ambient Air Monitoring Network Assessments.

Credits

- **Ben Wells** - 2020 Network Assessment Tools
- **Eric Bailey** - 2015 Network Assessment Tools
- **Nathan Byers** - 2015 Network Assessment Tools
- **Cassie McMahon** - 2015 Network Assessment Tools
- **Donna Kenski** - 2015 Network Assessment Tools
- **Mike Rizzo** - 2010 Network Assessment Tools

Software

The NetAssess2020 app was created using the R shiny software package, with custom HTML, CSS, and javascript. The javascript library leaflet and many of its plugins were used to make the maps. The source code and data for the NetAssess2020 App is available on GitHub.

Acknowledgement

The Site Correlation, Exceedance Probability maps, Area Served and Removal Bias tools were prepared by the Lake Michigan Air Directors Consortium (LADCO). Please visit their website to learn more about these tools.

http://ladco.github.io/NetAssessApp/